APPLIED HYDRAULICS

APRIL 1955

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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FRANCHISE CIRCULATION

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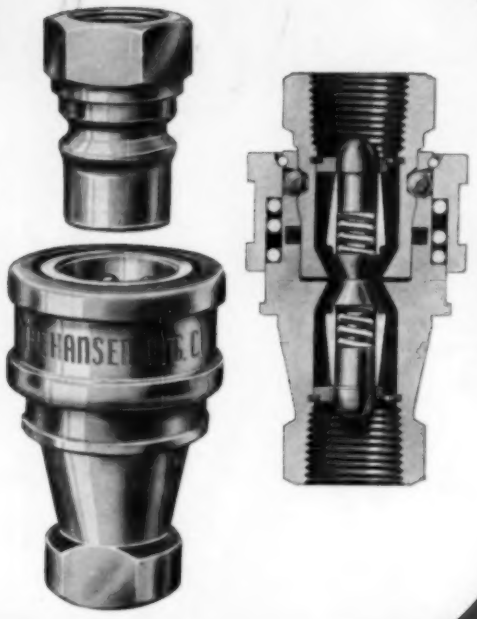
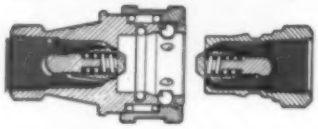
HANSEN

QUICK-CONNECTIVE
2-WAY SHUT-OFF
COUPLINGS!



QUICK CONNECTION AND DISCONNECTION

INSTANT AUTOMATIC FLOW OR SHUT-OFF



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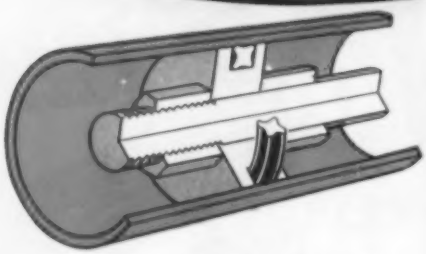

1. **PACKING** for reciprocating motion in hydraulic and pneumatic devices. New design eliminates "spiral twist," a common cause for packing failure. Users have reported *much less drag and breakaway* in installations where QUAD RINGS have replaced O-Rings and other types of packing. Leading edge of QUAD RING acts as a wiper ring to minimize abrasion and prolong service life. QUAD RINGS form a *positive seal* under a wide range of pressures—are particularly efficient at 0 to 5 psi. Where O-Rings and other packings fail in performance, try QUAD RINGS.

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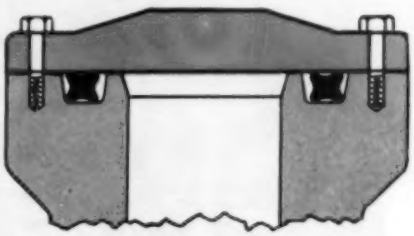

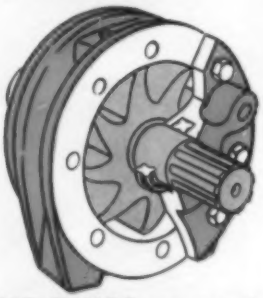

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APPLIED HYDRAULICS

VOLUME 8 NUMBER 4

APRIL 1955

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BPA

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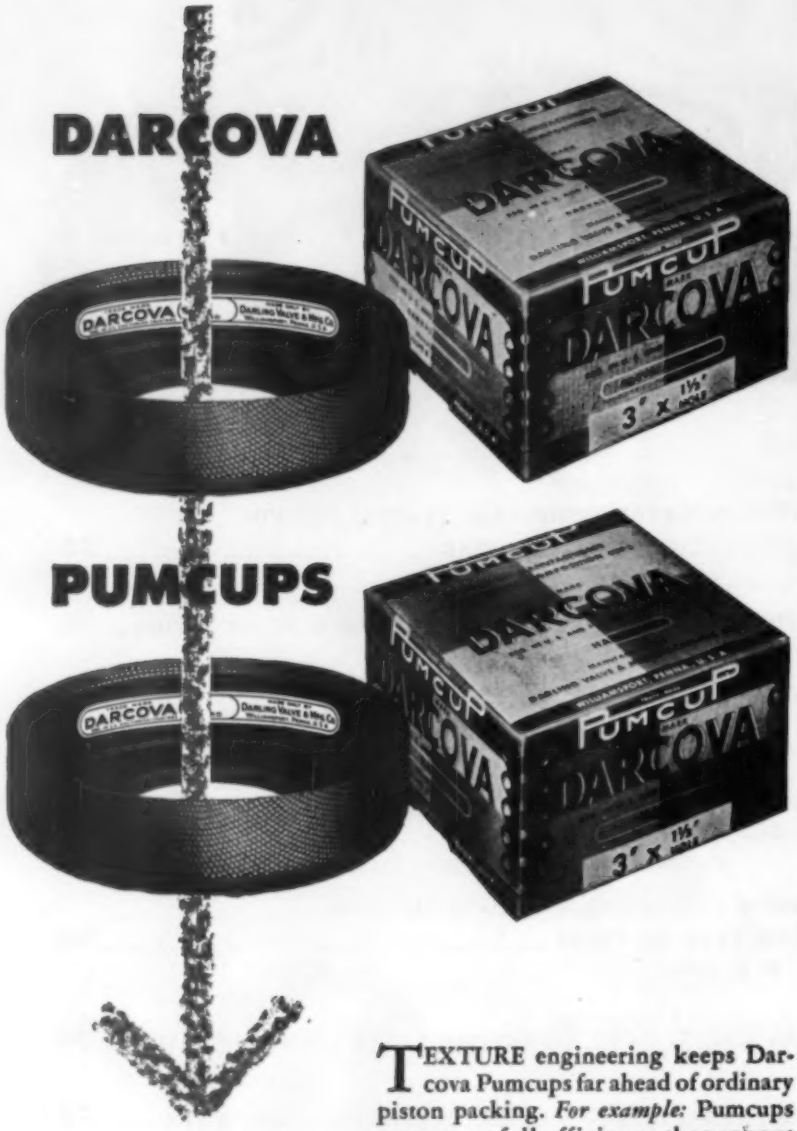

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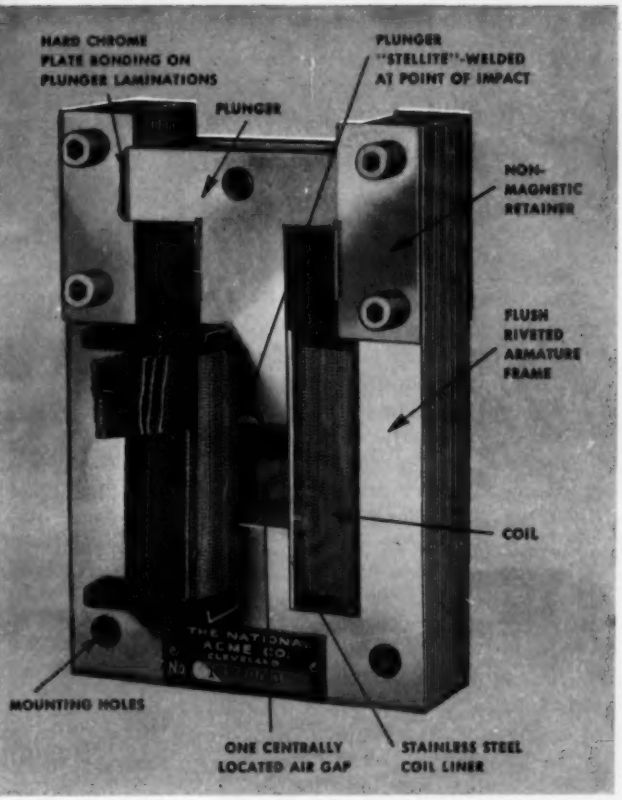
- sort inspected parts



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Fluid Power Lines

about Applied Hydraulics

We wore a hat . . .

. . . to catch the foundry sand as we took pictures of the tunnel located hydraulic system described in this month's lead article. After our 15 minute tour of the tunnel we scientifically measured the sand caught by our favorite fedora and then by taking time, area, distance, vibration and orneryness into consideration concluded that the hydraulic system had to work under a heck of a lot of sand. Nevertheless the system holds up many times better than our hat and certainly this application proves that oil driven machines in a foundry are practical.

Dick Ogilvie of National Malleable showed us how this transfer system works, and Bill Howells, the plant engineer, added information on the design.

Gremlins in the Drain Line

We usually treat drain lines with very little respect. They're of course necessary on many valves, pumps and motors to carry off leakage or pilot flow, so we add them rather begrudgingly and then hope we can forget them. All too often it seems that these drains are a fine hiding place for little troublemakers who make valves do unexpected things.

Ed Gatwood tells how to attack these drain line gremlins in a short article on page 74. His solution is to make sure that the gremlins get a one way ride back to the reservoir.

Big Winches

There's a good future for hydraulic transmissions on winches. Cargo handling in and out of the big ships is one of the growing applications. With big ships having to spend more time in port than at sea, here's the place where dollars can be saved. Design of a typical cargo winch is detailed in E. C. Milde's article.

Speed Control . . .

. . . depends on the rate of flow of oil. Easy to say—but very hard to do. Of all the various types of hydraulic circuits, we believe that those designed for speed control are the most important and often the least understood by men learning to apply hydraulic circuits. J. R. Fawcett authors an article which reviews many of the circuits used to regulate speed of motors and cylinders. In following issues, there will be short detailed articles on several control circuits which have been developed in England.

Design of Hydraulic Snubbing Devices

Every so often the mail brings us a request for information about the design of cushions in hydraulic cylinders. These readers want to learn how to develop the taper of the cushion pin.

Cushions serve the very important function of slowing down piston travel at the ends of a stroke. Usually the design is pretty much cut-and-try. When the acceleration or deceleration control is critical the cut-and-try procedure doesn't always pay.

How can the needle contour be determined? What are some of the designs of snubbing mechanisms for hydraulic cylinders? Answers

to these questions are given by Glenn L. Martin's Chief Mechanical Engineer, Everett G. Gravenhorst, in this month's Aviation Section. The described technique and designs can readily be applied to equipment other than aircraft.

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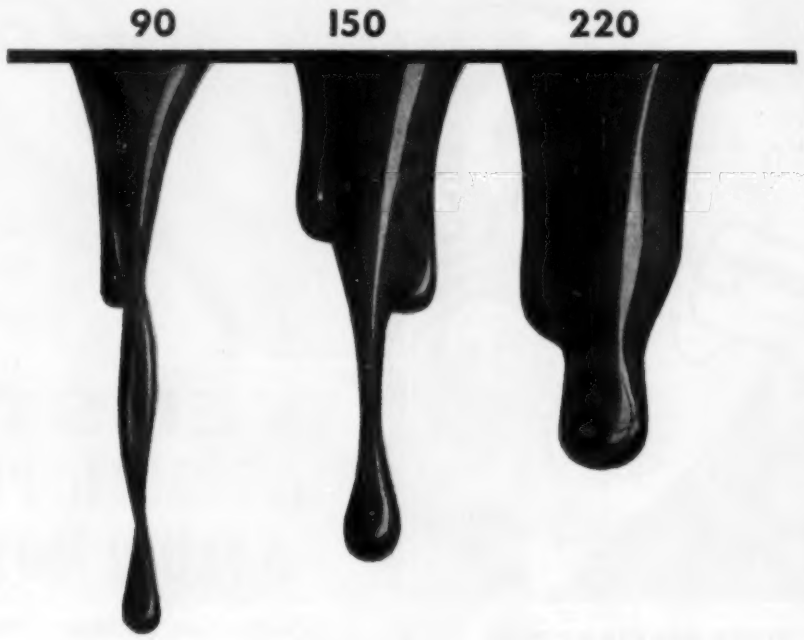

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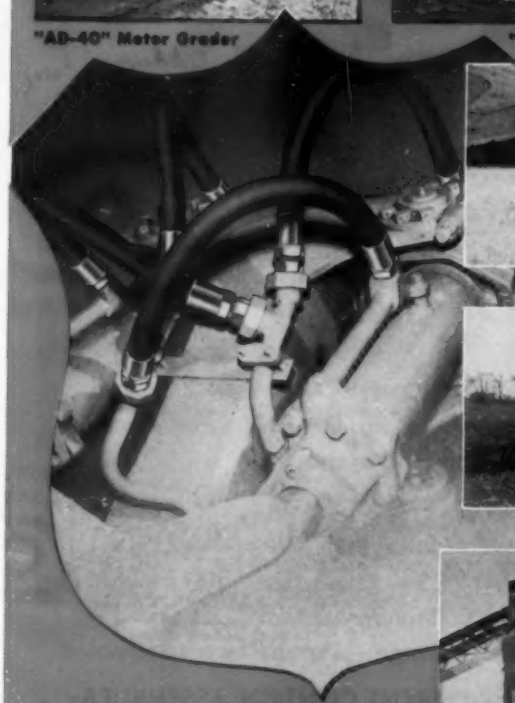
The millions of years required by the glaciers to scour and alter the earth diminish to mere minutes when Allis-Chalmers earth moving and grading machinery go to work. Many of these mighty machines owe much of their ease of operation and maneuverability to hydraulic power—delivered through **EASTMAN** Hydraulic Hose Assemblies.



ALL-CROP Harvester

TODAY'S FARM YOUTH NEVER BORN "30 YEARS TOO SOON"

Milestones in farm mechanization are marked by Allis-Chalmers farm machinery. Pioneering in many farming innovations resulted in such exclusive firsts as the ROTO-BALER, ALL-CROP Harvester, Rear-Engine Tractor—Power Shift Wheels, SNAP-COUPLER and Hydraulic Traction Booster. Much of the operation and control of this world famous line of farm machinery is done through hydraulic power—also applied through **EASTMAN** Hydraulic Hose Assemblies.

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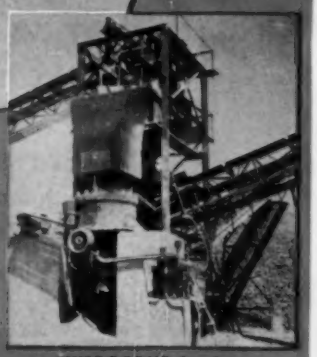
NATURE NEVER CRUSHED ROCK LIKE THIS . . .

Hydraulic power on the HYDROCONE crusher affords "one man, one minute" product size control. It provides a rapid and convenient means of raising or lowering the crushing head. It permits compensation for wear and facilitates emptying the crushing chamber in case of power failure or for the quick release of uncrushable materials. Allis-Chalmers pioneered in this type of crusher—as **EASTMAN** pioneered in Hydraulic Hose Assemblies.

Eastman Hydraulic Hose Assemblies used on steering ram of Allis-Chalmers TS-300 and TS-360 Motor Scraper. Also used on TS-200 Series to control steering, plus apron, ejector and bowl action—applying down pressure when loading equal to the weight of the scraper—38,560 lbs.!



HYDROCONE Crusher

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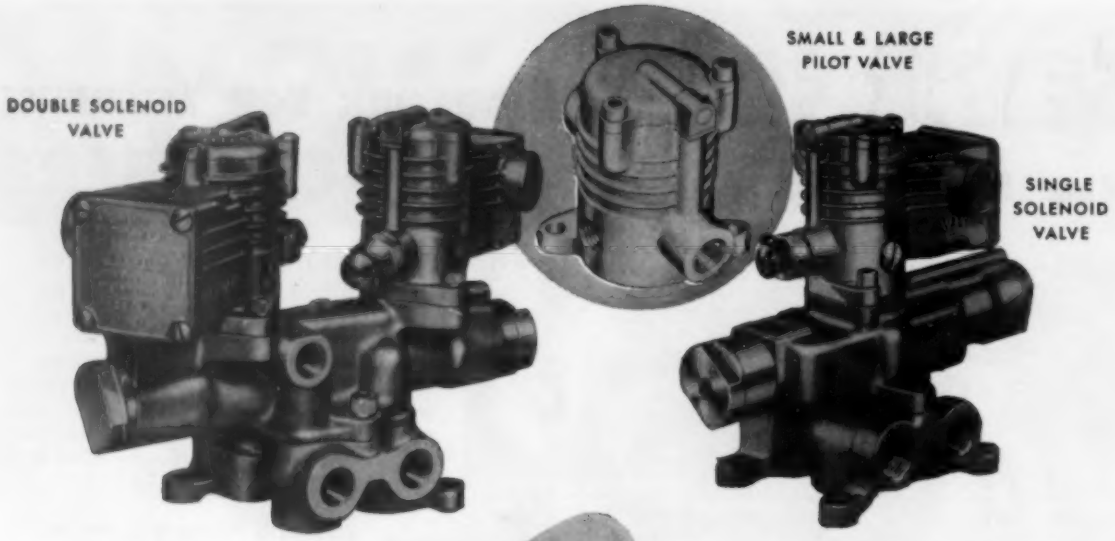

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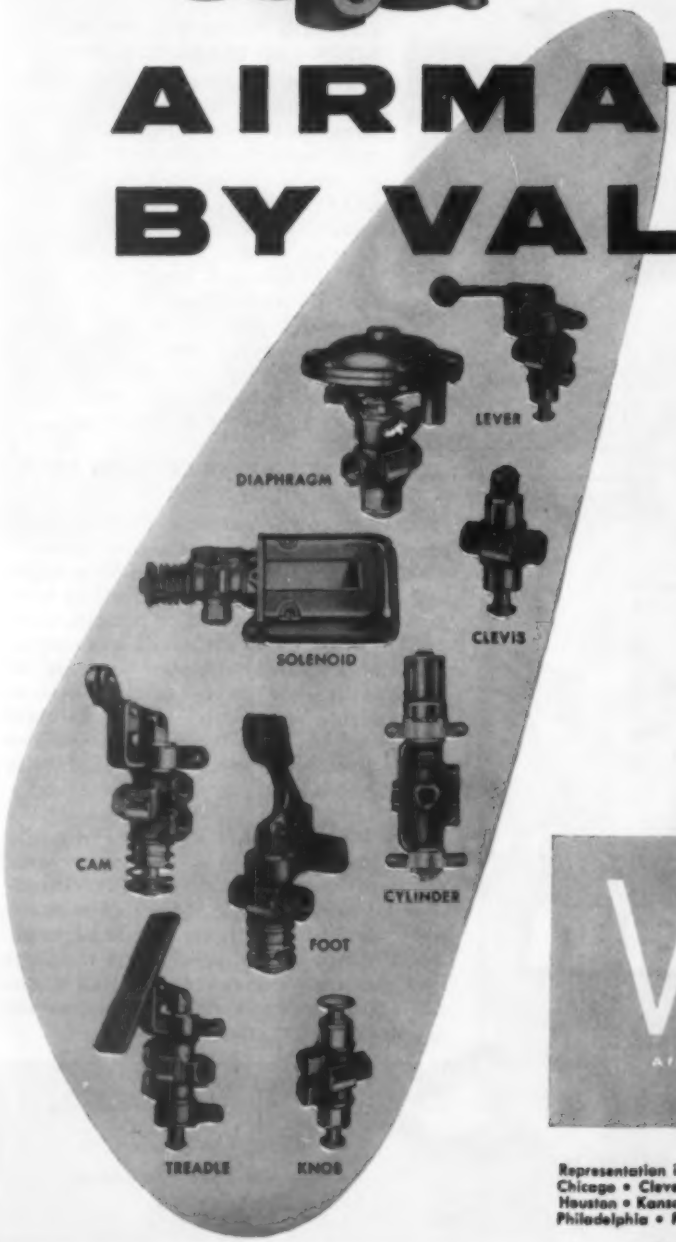

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BRIEFS about fluid power

JUDGES FOR 1955 PRIZE PAPER CONTEST

Three engineers who are actively participating in the fluid power field have accepted the invitation to serve as judges for this year's APPLIED HYDRAULICS Prize Paper Contest. To learn how to enter the contest see page 121.

David Hutchinson
Sundstrand Machine Tool Co.

William E. Adamek
Fisher Body Division
General Motors Corporation

Joseph F. Ziskal
International Harvester Co.

● David Hutchinson joined Sundstrand Machine Tool Company's Hydraulic Division eight years ago, doing application and field work on hydraulic equipment. For the last three years Hutchinson has been with the Machine Tool Section, where he is responsible for the circuit design and application of hydraulic and pneumatic equipment to machine tools. He attended Illinois Institute of Technology.

● William E. Adamek is senior production engineer in charge of design, fabrication and application of hydraulic and electrical equipment for automobile body production. He holds a B.E.E. degree from the University of Detroit. In 1939 Adamek came to the Electrical and Hydraulic Department of Fisher Body Division, General Motors Corporation, after he had worked for four years as switchboard and panelboard engineer for the Square D Company.

● Joseph F. Ziskal has for many years been engaged in the design and testing of hydraulic lifting devices for farm equipment. Associated with the International Harvester Company since 1928, Ziskal has been chief engineer, Hydraulics Section, Advanced Engineering Group, since 1950.

While serving his apprenticeship with the company, Ziskal took engineering courses at Lewis Institute, Armour Institute and Illinois Institute of Technology. He is a member of the executive committee of the National Industrial Hydraulic Conference. ▼▼▼

Powdered Steel Gears For Hydraulic Pumps

After two years of cooperative research, three companies developed the successful application of powder metallurgy techniques to the production of high strength machine parts requiring properties of solid alloy steel.

Continued on page 18

Keelavite hydraulics

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CYLINDERS · TRANSMISSIONS · REMOTE CONTROLS

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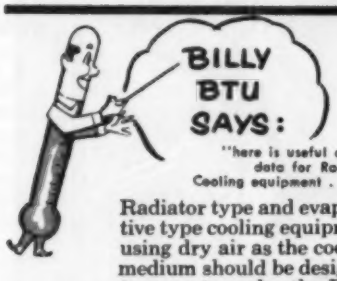
Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

Lufkin Selects Young Coolers to Reject Heat of Friction in Speed Increasers



Radiator type and evaporative type cooling equipment using dry air as the cooling medium should be designed to operate under the DRY BULB air temperatures to be expected during the summer in the locality where the equipment is to operate. Equipment using cooling effect due to water evaporation is designed to operate under the WET BULB air temperatures to be expected.

For proper design, it is not satisfactory to use either the maximum air temperature, nor the average air temperature. Use of the maximum air temperature for design would result in the selection of cooling equipment too large to be economical, since it would be fully loaded only under the most extreme temperature conditions. Use of average temperature for design purposes would result in selection of equipment too small to handle the cooling load during a great portion of the operating time. It is necessary, therefore, to use some figure between maximum and average air temperatures.

The Young Radiator Company has prepared and offers to engineers engaged in the design and application of radiator type and evaporative type cooling equipment, data taken from the results of five years of summer records in the United States. This data may be used and considered as applying to an average year.

For a copy of this data, write for Bulletin 654, Young Radiator Company, Racine, Wisconsin.

Extend bearing life, improve lubrication with Young Cooler

Lufkin Foundry and Machine Company, Lufkin, Texas, specifies Young Radiator Company Type "F" Shell and Tube Heat Exchangers to cool Speed Increaser lubricating oil.

The Lufkin Type N3012 Speed Increaser weighs 12,000 pounds and will drive a 99 horsepower, 3,600 rpm centrifugal pipe line pump.

Gears and bearings are lubricated by force feed from a lubricating pump. Oil is picked up from the bottom of the pump and passed through the Young two-pass Heat Exchanger and flows to the bearings and gear mesh.

Oil cooling is necessary with Speed Increasers because a percentage of the horsepower applied to the input side is used in overcoming friction. This horsepower loss is converted into heat giving rise to oil temperatures of 220 F., or higher. By lowering the oil temperature lubrication is improved and bearing life extended.

Recognized for their compactness in design, Young Heat Exchangers are used for any kind of fluid to fluid cooling. Single or multi-pass units, in fixed or removable tube bundles. Available in ferrous or non-ferrous metals for quick delivery from stock. Write for free catalog No. 1254.

Lufkin Type N3012 Speed Increaser designed to drive a 900 hp pipe line pump, and cooled by Young Radiator Company Heat Exchanger (encircled).

Young Type "F" two-pass Fixed Tube Bundle Heat Exchanger used on Lufkin Speed Increaser.

WRITE FOR FREE DESIGN TEMPERATURE BULLETIN OF THE UNITED STATES

Helpful four-page Bulletin briefly discusses atmospheric cooling equipment design temperatures for the United States. Wet and dry bulb maps are fully illustrated with isothermal lines. Write Young Radiator Company, Dept. 445-D, Racine, Wisconsin.

Young RADIATOR COMPANY

RACINE, WISCONSIN

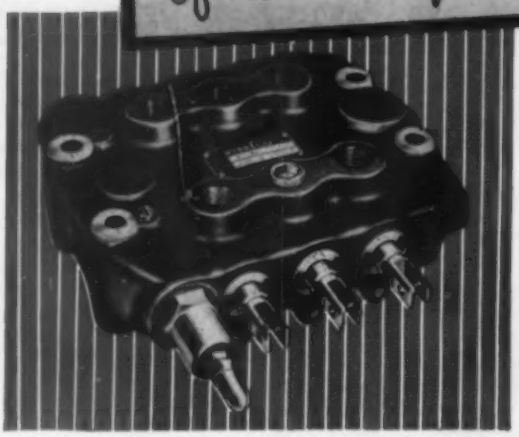
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

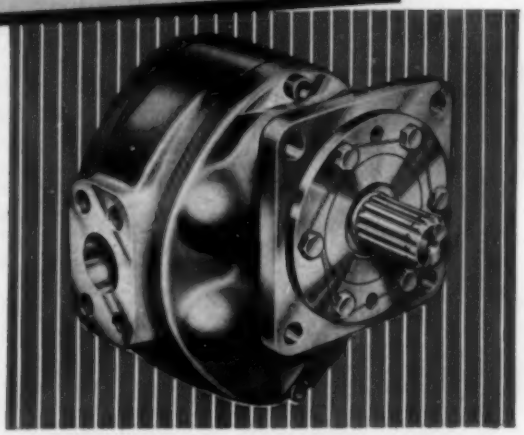
PUMPS
MOTORS
ENGINEER'G
VALVES
CYLINDERS

Mr. Hydraulics Engineer—
We suggest that you'll want to be familiar with these important developments in Fluid Power . . . products of The New York Air Brake Co.



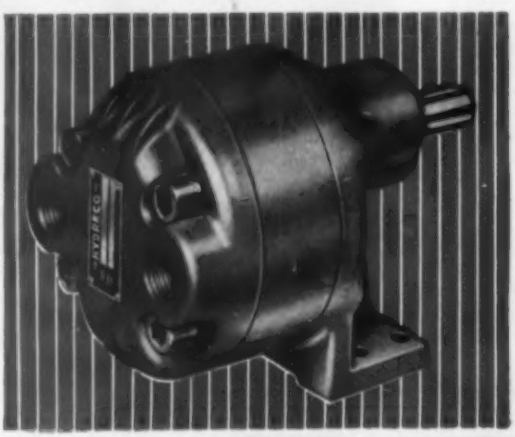
HYDRECO HOLLOW-PLUNGER CONTROL VALVES

The advancements made by HYDRECO engineering in multiple plunger, single and double acting control valves bring you new, accurate throttling . . . smooth, positive, fingertip control with notable freedom from binding, chattering or troublesome back pressures. Valves with 1 to 5 plungers in capacities from 5 to 80 gpm and operating pressures of 1500 and 2000 psi are now available for your present and projected equipment.



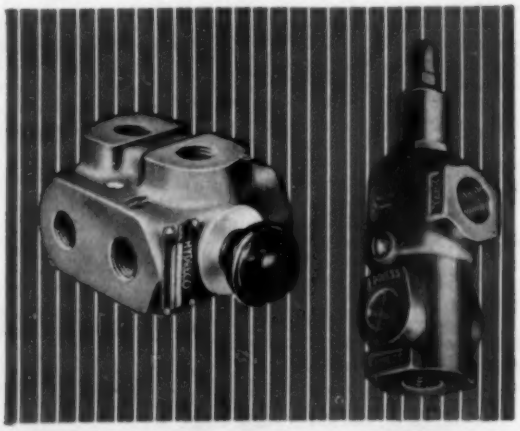
HYDRECO GEAR-TYPE PUMPS 1000/1500 psi

HYDRECO engineers have shattered the illusion that "any gear pump is just a gear pump". New developments in the famous HYDRECO Four-Bolt design provide higher pressures, higher speeds and higher efficiencies than were previously available. You'll want to know more about the many Heavy Duty features in HYDRECO Pumps. A full range of sizes — 3.3 to 55 gpm at 1200 rpm, 1000 psi.



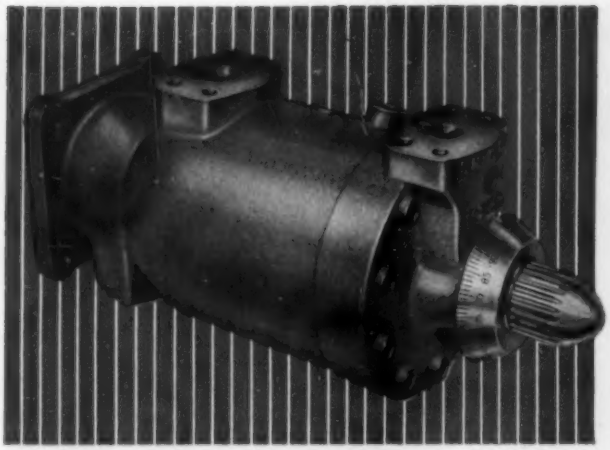
HYDRECO FLUID POWER MOTORS 1000 psi

For the many applications which call for reversible rotary motion with high starting and running torques...HYDRECO Four-Bolt, Gear-Type Fluid Motors are the economical and reliable answer. Precision, ruggedness and simplicity combine to ideally suit these motors to machine tools, oil drill rigs, conveyors, agitators and a thousand other uses. Sizes 3 to 17 hp at 2000 rpm, 1000 psi.



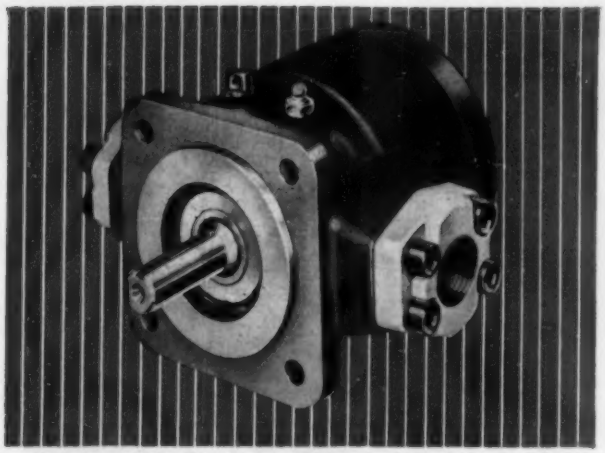
HYDRECO AUXILIARY VALVES 1000/2000 psi

HYDRECO engineers have made very important contributions to the modern hydraulic system in the Relief and Selector Valves now available for your applications. For accurate control over a long service life, HYDRECO Relief Valves in capacities to 80 gpm serve without chatter, squeal or whistle. The Selector Valves enable you to perform additional operations with your system, and these are available in capacities to 50 gpm.



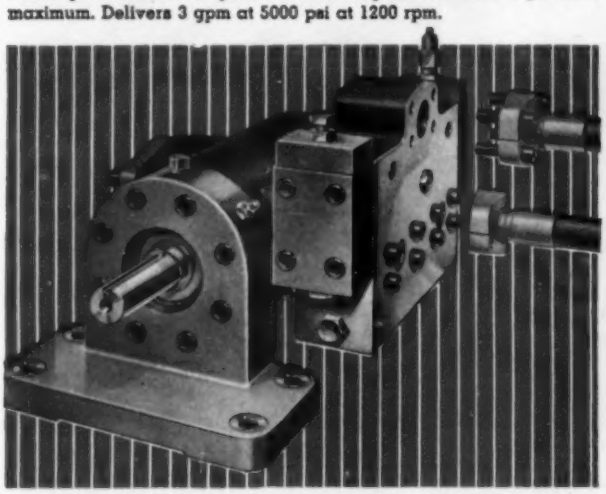
DUDCO VARIABLE DELIVERY PISTON PUMPS 5000 psi

The PV-600 Variable Delivery Pumps give designers a source of Fluid Power that is modern, compact, flexible, efficient and economical. These pumps are offered with two types of Variable Delivery Control. The handwheel Control provides accurate manual adjustment of delivery from zero flow to full flow. The Pressure Compensated Type features automatic pressure and flow control . . . delivery is reduced as pressure in the system reaches a pre-fixed maximum. Delivers 3 gpm at 5000 psi at 1200 rpm.



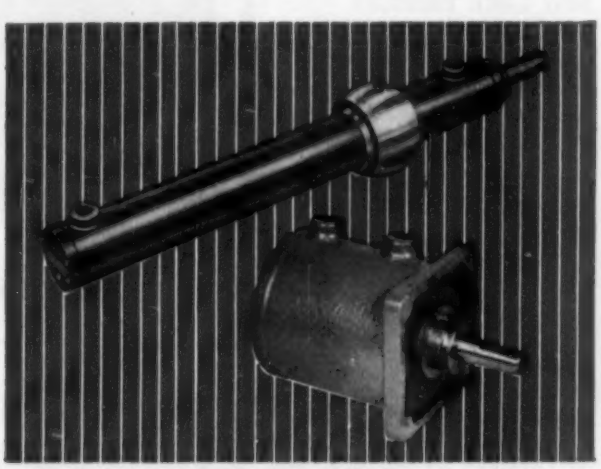
DUDCO DUAL-VANE HYDRAULIC PUMPS 2000 psi

Featuring a simplified, 3-unit construction, these DUDCO PF-100 Pumps provide designers with "a High Pressure Pump at a Low Pressure Price". The fully balanced DUAL-VANE construction assures high efficiency at higher pressures with wear reduced to an absolute minimum. Interchangeable Cam Rings add a factor of flexibility that conserves time and money. Available in flange and foot-mounted models, 3 to 11 gpm at 1200 rpm . . . 2000 psi.



DUDCO DOUBLE PUMPS WITH VALVE PANELS 2000 psi

These integral units meet the broad demands of circuits which call for substantial variation in pump volume, such as: "close and hold" or "traverse and feed" cycles. Hydraulic Presses, Plastic Molding Machines and many Machine Tools find these units highly efficient in operation, low in first cost, dollar-saving in reduced piping and valving in the circuit and supremely simple to service. Can be used in the operation of two separate systems or for Hi-Lo circuits.



HYDRECO CUSTOM-BUILT CYLINDERS

HYDRECO Hydraulic Cylinders enjoy an established reputation for quality and dependability. To achieve this degree of dependability entails craftsmanship and manufacturing niceties not practical in so-called standard cylinders built to meet a price. For engineers who seek performance, long-wear under heavy duty conditions and unmatched leakproof qualities, HYDRECO engineering and craftsmanship have something of special interest to offer.

Bring your Hydraulics Data up-to-date . . . Write for your FREE Bulletins TODAY!

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HYDRECO DIVISION
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DUDCO 2000 psi Pumps ☐ 5000 psi Pumps ☐ Motors ☐
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NEW BACK PRESSURE RELIEF VALVE...

SHUTS OFF TIGHT

WITH PRACTICALLY NO PRESSURE DROP BELOW RELIEF SETTING

CHATTER FREE

For Pressures From 0 to 400 Pounds P.S.I.

Extra Large Capacity • Unusually Sensitive

- Available in iron, bronze, monel or stainless body. Size ½ to 2" inclusive, with bronze, monel or Neoprene diaphragm.
- Suitable for use on practically all fluids and gases. Especially suited for oils of all grades, including Bunker "C".
- For additional information on Type FR, and other new automatic valves in the Cash-Acme line, write our Engineering Department at the address below. To avoid delay, please include a brief outline of your pressure conditions and requirements.

Cash-Acme's Type FR back pressure relief valve automatically maintains correct pressure on the inlet side, by relieving into a lower pressure line. It is not affected by pressure variations on the discharge side. Provides protection against periodic high pressure conditions. Can be used with modification as a differential pressure regulator—holding a constant difference in pressures between valve inlet and valve outlet. Valve action is fully floating for smooth and even control. New patented "Floating ring" is unusually sensitive—gives exceptionally good closure. Large capacity in almost frictionless performance.

CASH ACME

A. W. CASH VALVE MANUFACTURING CORP.

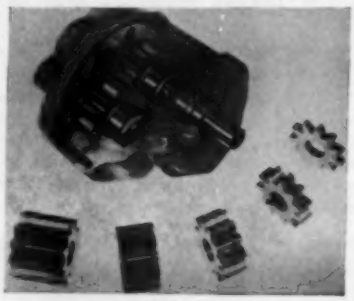
6629 E. Wabash Avenue Decatur, Illinois

The Complete Cash-Acme Line Includes Pressure Reducing and Regulating Valves, Relief Valves, Back Pressure Valves, Vacuum Regulators and Vacuum Breakers, Differential Pressure Regulators, Strainers, Diaphragm Control Valves.

I—4-55

BRIEFS continued

Vanadium-Alloys Steel Company developed the steel powder, a prealloyed type made by water disintegration of molten metal. Keystone Carbon Company fabricated the steel powder into gears, with tensile strength exceeding 100,000 psi. Hydreco Division of New York Air Brake Company made the extensive tests of performance and durability, and are the first to use



this kind of gears in its line of hydraulic pump equipment.

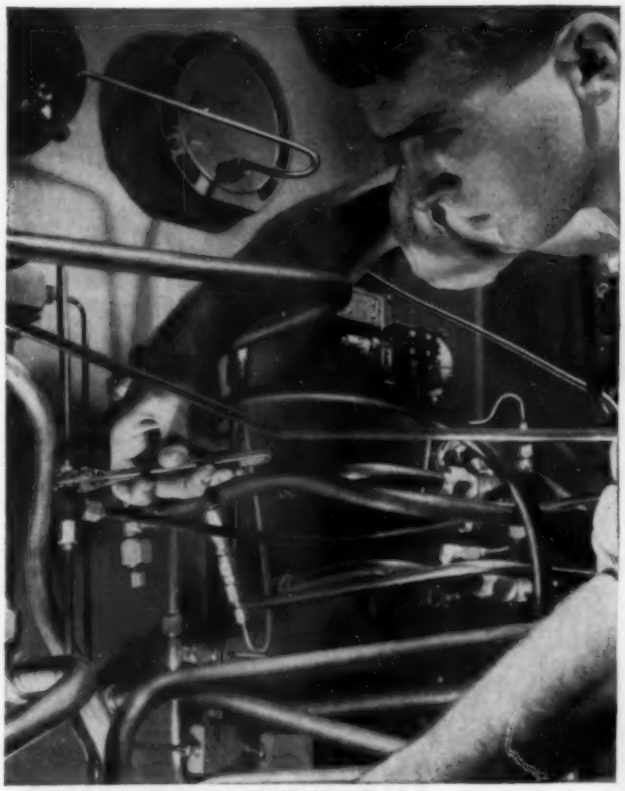
Reports, after thousands of test hours in the laboratory and in the field, indicated that the performance of the new gears was equal, if not superior to the cut gears originally used.

Uniformity of one gear to another and superior surface finish—both features very important in a hydraulic pump because its volumetric efficiency depends on the seal made by the mating of the gears' teeth—resistance to wear, very high strength, as well as cost reduction, were factors which led Hydreco to approve these gears for production. ▼▼▼

NBS Advisory Committees Established

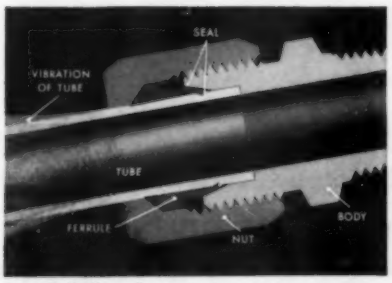
During the past year, 12 technical area advisory committees have been established, providing a direct continuing link between the National Bureau of Standards and the organized science and technology of the Nation. Nine scientific and engineering societies have nominated advisory committees to the Bureau. These have

Continued on page 21



"Tube up and forget it" with leakproof Parker fittings

Triple-lok flare fittings are the easiest, fastest and safest way to tube up even in close quarters. They are absolutely leakproof even under the severest conditions of vibration, high pressures and temperatures. *Triple-lok* fittings meet J.I.C. and S.A.E. Standards plus specifications of the A.S.M.E. Code for Pressure Piping. Available for tubing outside diameters from ⅛ through 2 inches. More *Triple-lok* fittings are used on industrial machinery than any other fittings.



Ferulok flareless fittings, featuring the visible "bite", are especially for high-pressure, heavy-wall tubing. Cutaway shows why vibration won't break the seal.

New Hoze-lok fittings and hose assemblies (for medium and high-pressure hydraulic service) offer better performance, easier make-up, greater re-usability.

New Weld-lok fittings are machined from high-quality steel or stainless-steel bar stock and forgings. They are available for tubing ¼ through 2 inches, O.D.

New Intru-lok tube fittings can be quickly installed by anyone. Simply push tube in, then tighten nut. Designed for instrumentation lines of ¼ through ½ inch, O.D.

Other Parker products include new hydraulic control valves, check valves, accumulators and O-rings. Mail the coupon for the fitting catalogs you want.

TUBE AND HOSE
FITTINGS DIVISION
Section 411-F

The Parker Appliance Co.
17325 Euclid Avenue
Cleveland 12, Ohio

- ☐ Send Triple-lok & Ferulok Catalog No. 4300
- ☐ Hoze-lok Catalog No. 4400
- ☐ Weld-lok Catalog No. 4370
- ☐ Intru-lok Catalog No. 4320A1

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Parker

Hydraulic and fluid system components

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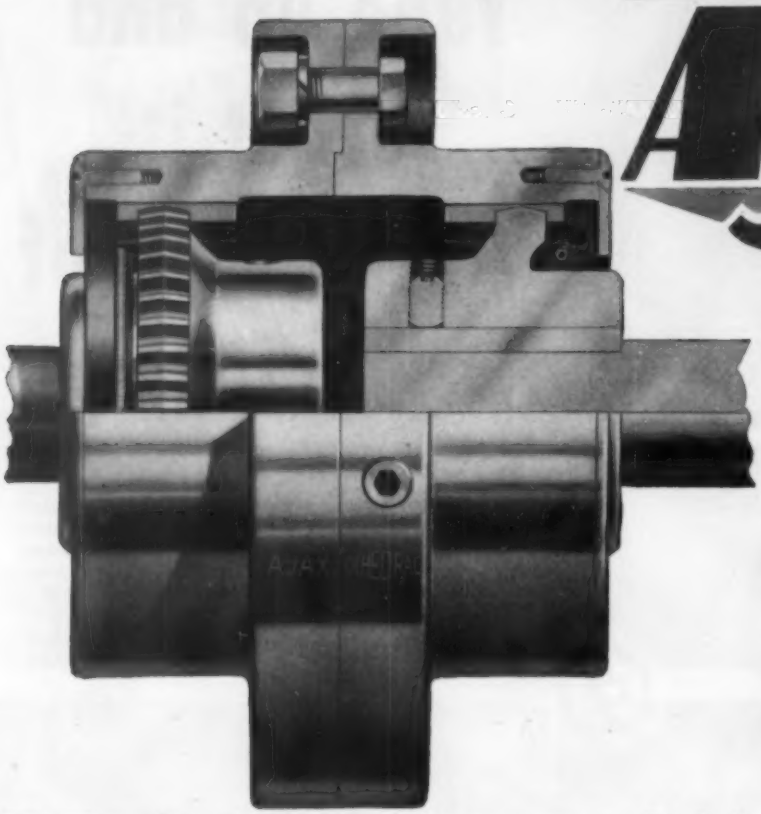


DIHEDRAL COUPLINGS

because
the best coupling is the cheapest

Whether your executive position concerns design, manufacturing, selling, maintenance or service,—the performance of your equipment depends on the coupling!

AJAX Dihedral Couplings are radically improved gear-type couplings designed to handle offset, angular and end float shaft misalignment far beyond capacities of conventional flexible couplings.

Simplify your machine design, manufacturing, installation and maintenance. AJAX Dihedral Couplings make it possible to design misalignment into heavy duty equipment as well as out.

Exclusive AJAX Dihedral tooth design* permits holding tooth clearance (backlash) to lubrication film requirements. Load is distributed at center of teeth, the point of greatest strength. All teeth are hardened to combine hard wear surface with tough core. Seals keep lubrication IN.

Phone the AJAX representative or write the factory for case histories,—you will spark-plug some worth-while thinking.

Also manufacturers of a complete line of AJAX Rubber-Bronze Bushed Couplings and Vibrating Conveyors.

Representatives in Principal Cities
Consult your Telephone Directory

AJAX FLEXIBLE COUPLING CO. INC.
WESTFIELD, N. Y.

*Patents Pending

BRIEFS / continued

selected their chairmen and have held meetings at the Bureau. It is felt that the special committees will prove a valuable source of consultation and stimulation which will strengthen the ties of the Bureau with American science and industry.

▼▼▼

Mower Has Hydraulic Drive

An independent hydraulic system to drive mower sickles has been developed for J. I. Case "VAIH" tractors.

Consisting of a gear type pump driven from the front of the engine crankshaft, a four-way valve and a reversible hydraulic motor, the system provides continuous, even power and constant speed. A built-in pressure relief valve will stop the knife if the blade gets jammed, and is usually cleared by reversing the direction of the knife. The valve is easily controlled from the operator's seat.

▼▼▼

"O" Ring Group Joins RMA

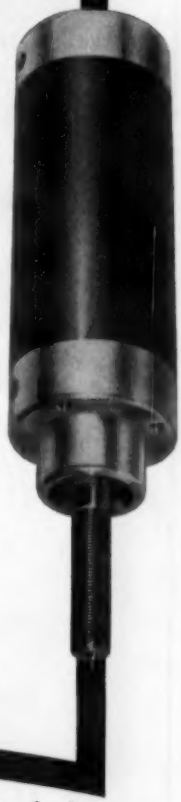
The Rubber Manufacturers Association recently admitted to its organization the "O" Ring Manufacturers Association, as a subdivision of the Mechanical Division. The first annual meeting under the new auspices was held last December.

At that meeting recommendations were made for a possible solution to the problem of shrinkages in silicone compounds and the new officers were installed to serve for one year. Chairman, R. E.

Continued on next page

NEW NP Power Drive Cylinder

. . . has all the "most wanted" design features



No other cylinder offers you so many vital features: compact, streamlined design; lightweight aluminum alloy and steel construction exceeds all strength requirements; interchangeable mountings — foot, flange, pivot, clevis and trunnion. Every cylinder can *operate with air, water or oil without interchanging or adding parts:* Adjustable cushioning (optional) can be added to any cylinder at any time.

PLUS

1. Sealed-in lubrication eliminates line lubricators.
2. Rod wiper and long, self-lubricating bronze rod bearing.
3. Self-compensating synthetic multiple "V" rod packing.
4. Rod packing and bearing externally removable.
5. Large porting gives quick response and smooth performance.
6. Rotatable end caps allow 360° piping location.
7. Rust-proofed cylinder tubing has tough I.D. surface.
8. Bronze piston bearing assures maximum support.
9. Ground and polished stainless steel piston rod.
10. Synthetic "U" cups automatically adjust for wear.

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INDUSTRIAL ACTUATORS AND CONTROLS DIVISION,
NATIONAL PNEUMATIC CO., INC.
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GENTLEMEN: Please send me complete information on

☐ NP Power Drive Cylinder ☐ NP Power Check feed control
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Hose Assembly Engineer

Anchor Coupling Co. Inc.
Libertyville, Illinois

HOWDY! I am one of the family here and I don't mind telling you that I am mighty jealous of the quality of Hose Assemblies that leave our plant carrying my name. They've got to be right! What is your hose assembly problem — what kind do you need — how many do you want — how fast do you want them?

Drop me a line and I'll send you a Bulletin which will apply to your need

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Branch Offices: Dallas, Tex.; Plymouth, Mich.

BRIEFS continued

Allen, Precision Rubber Products Co.; Vice Chairman, T. B. Keenan, Plastic & Rubber Products Co.; Executive Committee: R. E. Allen, T. B. Keenan; J. R. Elliott, International Packings Co.; F. A. Lewis,

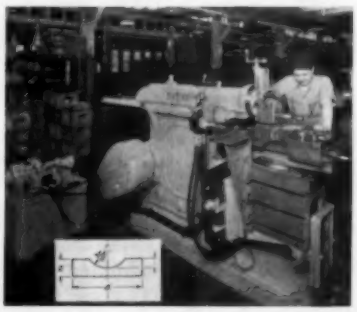
R. E. Allen
Precision Rubber Products Co.

Linear, Inc.; and A. W. McGuire, National Motor Bearings Co.

Allen appointed working committees and arrangements were made for the formation of statistical reporting procedures on monthly sales, bookings and industrial relations activities.

The subdivision is planning to hold its biannual meeting May 25-27, in San Francisco. ▼▼▼

Shaper Mounted Tracer



This heavy duty shaper, equipped with an automatic hydraulic follower, was installed at Ernst Iron Works' Buffalo plant. It accurately produces a radial hearing seat which formerly required two setups and two machining operations. The time for machining these plates was reduced from 75 to 20 minutes. ▼▼▼

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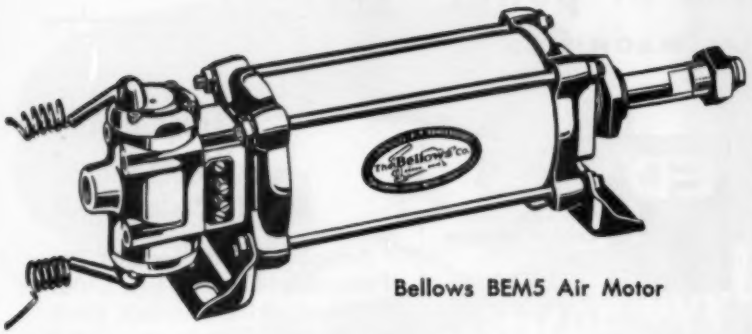


Bellows BEM5 Air Motor

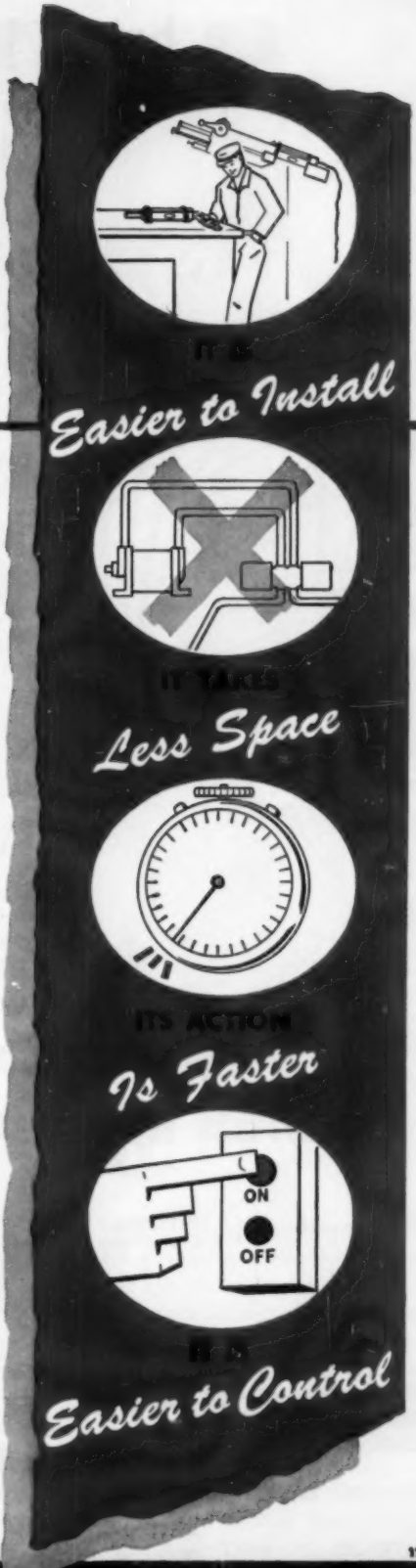
WHY YOU SHOULD BUY the AIR CYLINDER with the Built-in Valve

When it comes to down-right value, the Bellows Air Motor (the air cylinder with the built-in valve) tops them all for both standard air cylinder operations or as a component in new design applications. Not only are you buying a precision-built power unit — but you are buying a complete power unit. No extra valves to buy —dual speed control valves as well as directional valve are integral with the cylinder; no cumbersome, complex piping to install—a single, flexible air hose is all the hook-up you'll need.

You can have your choice of built-in directional valves: 110 volt or 8 volt electrical control, standard or explosion-proof, manual control, or air poppet valve control. Five bore sizes: 1¼", 1¾", 2½", 3⅝", and 4½". Any stroke length.

WRITE FOR THESE TWO BULLETINS:

Contain full data and specifications on Bellows Air Motors. Free. Address Dept. AH-455, The Bellows Co. Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd. Toronto.



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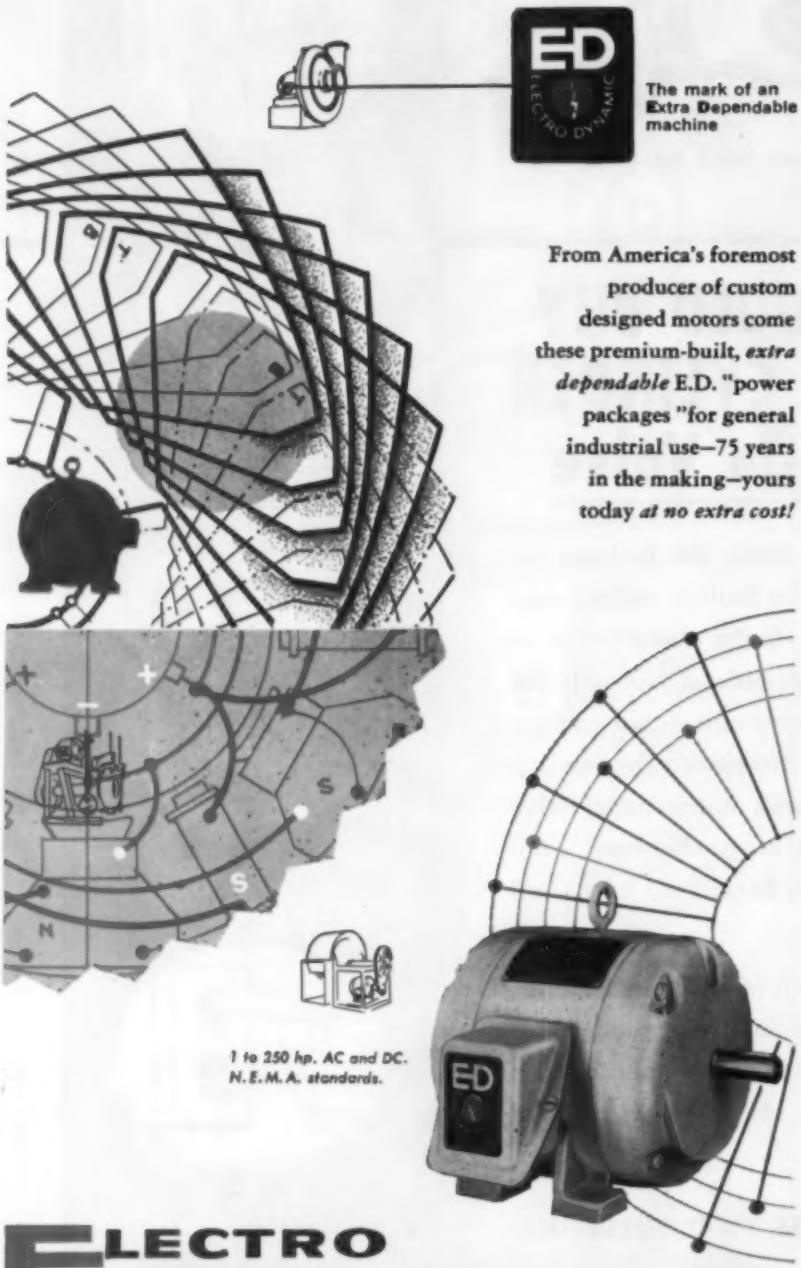
The Bellows Co.

AKRON, OHIO

a better kind of power

FOR INDUSTRIAL MACHINES



The mark of an Extra Dependable machine

From America's foremost producer of custom designed motors come these premium-built, *extra dependable* E.D. "power packages "for general industrial use—75 years in the making—yours today *at no extra cost!*

1 to 250 hp. AC and DC. N.E.M.A. standards.

ELECTRO Extra DYNAMIC dependable motors

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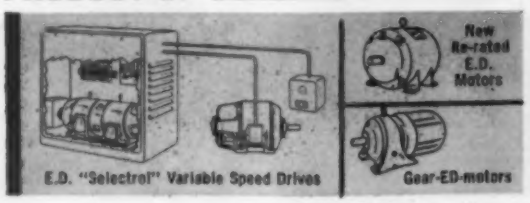
NEW...

Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



BRIEFS continued

Aeroquip And Weatherhead Settle Patent Suit

Aeroquip Corporation and The Weatherhead Company have settled the patent infringement suit, which has been pending in the United States District Court at Cleveland.

A royalty-paying, cross-licensing arrangement was concluded under the terms and each company will have the right to manufacture hose fittings and couplings under certain patents held by the other. Each concern recognizes the validity of the licensed patents of the other during the life of the agreement.

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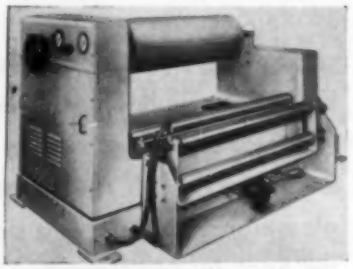
Web Backstand Uses Hydraulic Tension Control



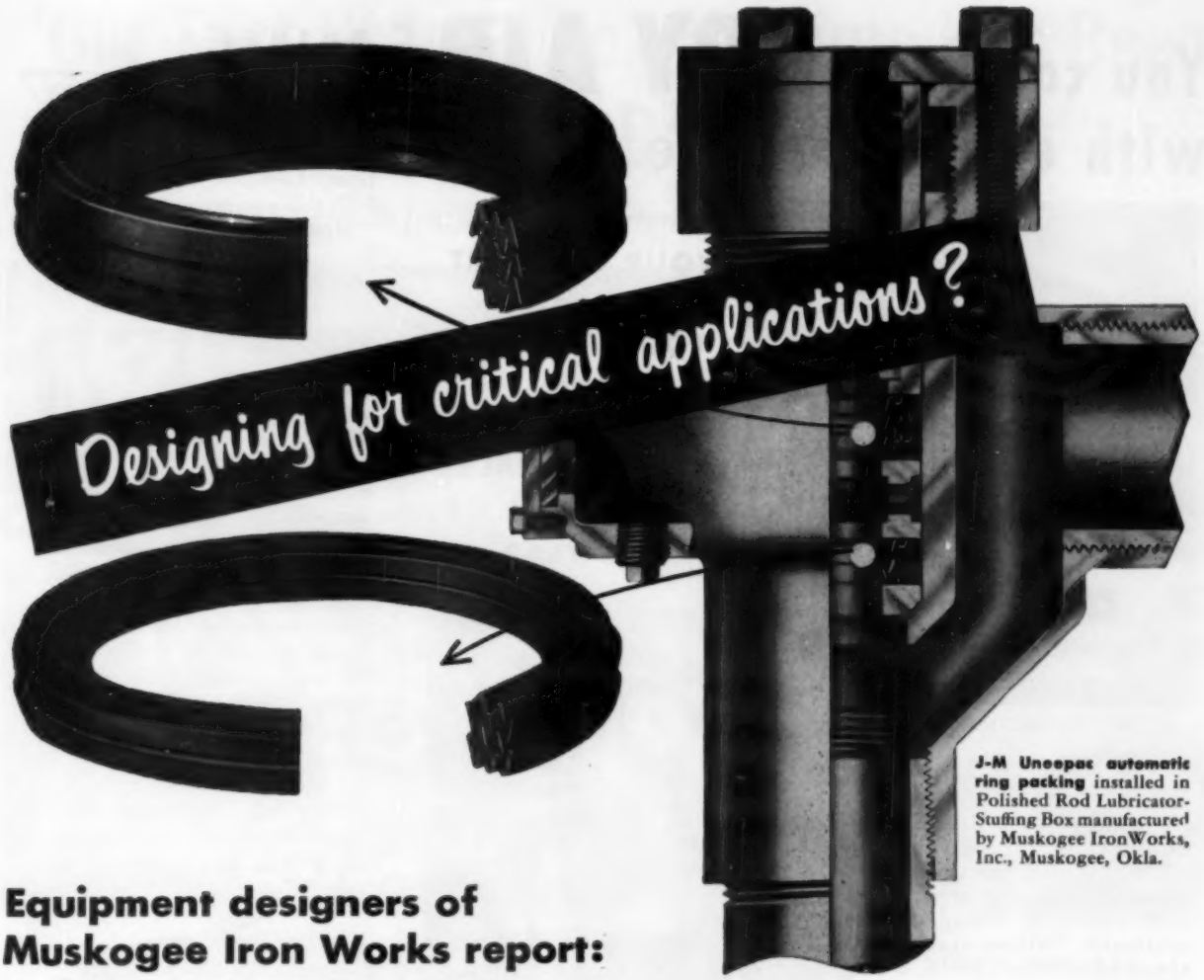
This backstand controls both tension and edge position of a moving web as it is fed to a rewinder, slitter or converting machine. Unit operates at speeds up to 1200 fpm. Tension control system is fully hydraulic. The use of incompressible fluid to transmit signals cuts response time to one-fourth that of an otherwise comparable pneumatic/hydraulic control system.

▼▼▼

1000-Ton Hydraulic Extrusion Press

For the production of low carbon steel bars, made by a special process, Jones & Laughlin Steel Corporation installed this new press. Designed to their specifica-

Continued on page 26



J-M Uneepac automatic ring packing installed in Polished Rod Lubricator-Stuffing Box manufactured by Muskogee IronWorks, Inc., Muskogee, Okla.

Equipment designers of Muskogee Iron Works report:

"Greatly increased packing life... Uneepac guards against pressure damage"

FOR THEIR NEW LUBRICATOR-STUFFING BOXES, design engineers of Muskogee Iron Works needed a packing with long service life as well as foolproof operation. Uneepac, the Johns-Manville automatic ring packing, fully met both of these requirements and contributed to the success and acceptance which the equipment has encountered.

In this application, Uneepac protects itself against damage by excessive gland pressure. The lips of each ring are guarded by the projecting portion of the Uneepac Center section. As a result, far greater service life and reliability is obtainable in this application than with other types of packings.

Uneepac offers many other important advantages for use in pump rods and plungers, compressors and similar equipment. Seals effectively in a minimum of space. Operates with minimum friction. Has excellent pressure sensitivity. Uneepac provides trouble-free operation because each ring positions itself diametrically as well as vertically. Header or follower rings are not always required because each Uneepac ring is a complete, self-protected unit.

To learn how Uneepac may aid your new equipment design, too, write for booklet PK-58A. Just address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

JM PRODUCT

Johns-Manville PACKINGS & GASKETS

You can have DRY AIR with exact moisture control

ASSEMBLING ELECTRONIC PARTS

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FOR YOUR PROCESS
FOR TESTING MACHINES OR MATERIALS AT ANY TIME OF THE YEAR

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● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

MOST FLEXIBLE. You can reach and hold any condition in response to instrument settings, or vary it as you wish.

EASIEST TO TAKE CARE OF. The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

MOST COMPACT. It does a very large amount of work in a small space.

INEXPENSIVE TO OPERATE. At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.

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Niagara District Engineers in Principal Cities of U. S. and Canada

BRIEFS continued

tions, Loewy-Hydropress, Inc., built this equipment.

Hydraulically powered, with a horizontal stroke, the press can operate at pressures up to 1,000 tons.

The production sequence is completely automatic. Heated billets of pre-determined size are brought to the loading end of the extrusion press. A hydraulic cylinder positions the hot billet, then pushes it through the die. The extruded bar is conveyed automatically to a cooling bed. J & L makes its own dies for the press. Lubricant used in the extruding process is powdered glass. ▼▼▼

Meetings In The Fluid Power Field

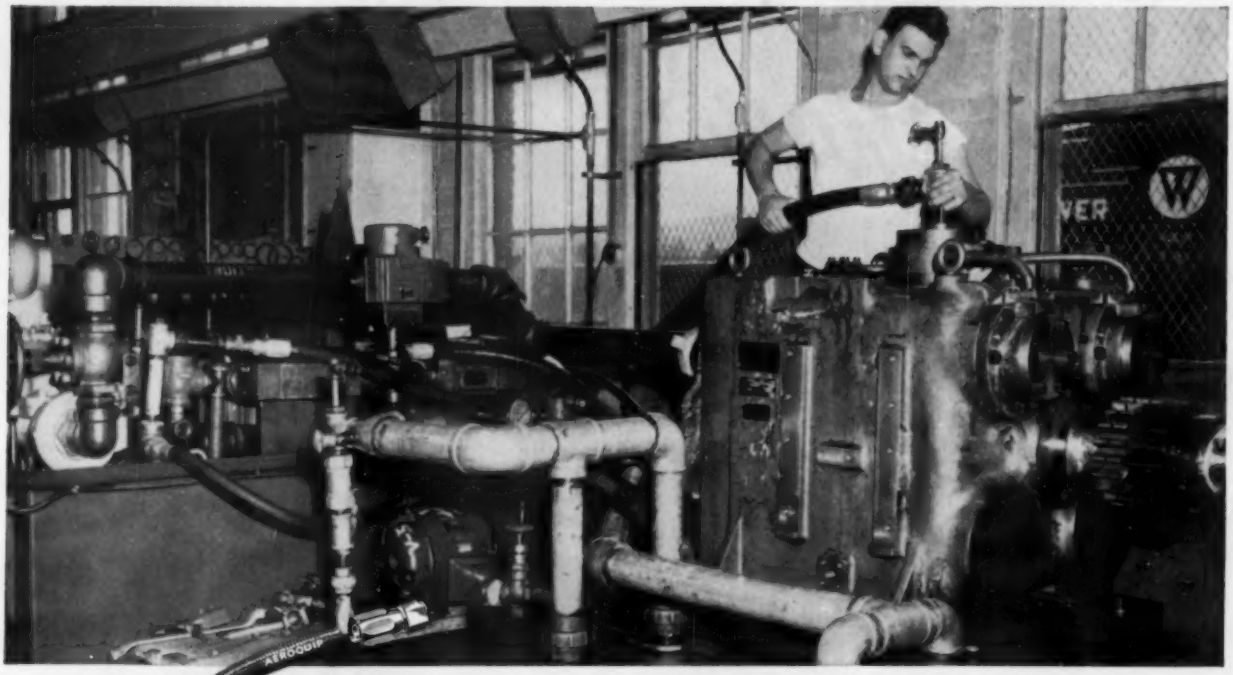
May 12-14: As part of the Centennial celebration at Michigan State College, the College of Engineering is sponsoring a symposium on "Automation—Engineering for Tomorrow".

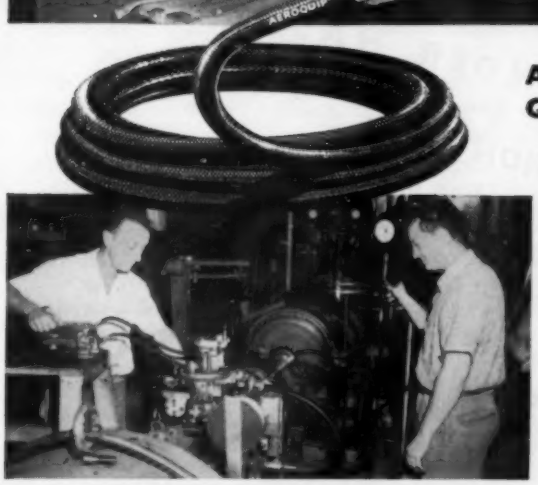
May 17-18: The 1955 Fabricating Machinery Hydraulic Conference, sponsored by Vickers Incorporated will be held at the Hotel Statler, Detroit. Open forum discussions will cover oil hydraulic systems, system problems for various types of machinery, with special emphasis on maintenance, installation, hydraulic fluids and seals. Attendance at the conference will be by invitation only.

October 27-28: The Eleventh National Conference on Industrial Hydraulics will be held at the La Salle Hotel, Chicago. ▼▼▼

"Our Test Stand Hook-Up Time Has Been Reduced From Days To Hours"

SAYS HENRY LEGERE, *Hydraulic Test Foreman, Waterbury Tool Division of Vickers Incorporated*





Size 5 heavy duty transmission for cargo winch drive shown in a typical test stand hook-up. Notice how Aeroquip flexible hose lines are used to eliminate need for alignment.

AEROQUIP FLEXIBLE HOSE LINES INSTALL QUICKLY...ELIMINATE ALIGNMENT PROBLEMS

Pressures as high as 5,000 p.s.i. are encountered in the testing of hydraulic equipment produced by Waterbury Tool Division of Vickers Incorporated, Waterbury, Conn. Aeroquip hose lines meet all performance requirements, and make it possible for laboratory personnel to make test stand installations quickly and easily.

Henry Legere, Test Stand Foreman, reports that one installation, normally requiring four hours to form and fit piping, is accomplished in *5 minutes* when Aeroquip hose lines are used!

A supply of Aeroquip bulk hose and reusable fittings will help you three ways: (1) Cut inventory because you can make Aeroquip hose lines to required length in minutes; (2) Cut installation time because all alignment problems are eliminated; (3) Eliminate failures because Aeroquip hose lines are exceptionally tough and durable.

Write for complete information.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

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Pathon

SERIES R H 2000 P.S.I. and SERIES Q H 1000 P.S.I. HYDRAULIC CYLINDERS

On all of your hydraulic cylinder applications the appropriate Pathon cylinder will give you the minimum in mounting size with increase strength and fatigue life.

A PATHON HYDRAULIC CYLINDER HAS...

LOW STRESS CONCENTRATION through the head to barrel attaching area providing a plus factor for shock loads. The single screw thread attaching method gives maximum strength in minimum space.

Our new thirty-two page bulletin covering these cylinders is now being distributed. Write for your copy.

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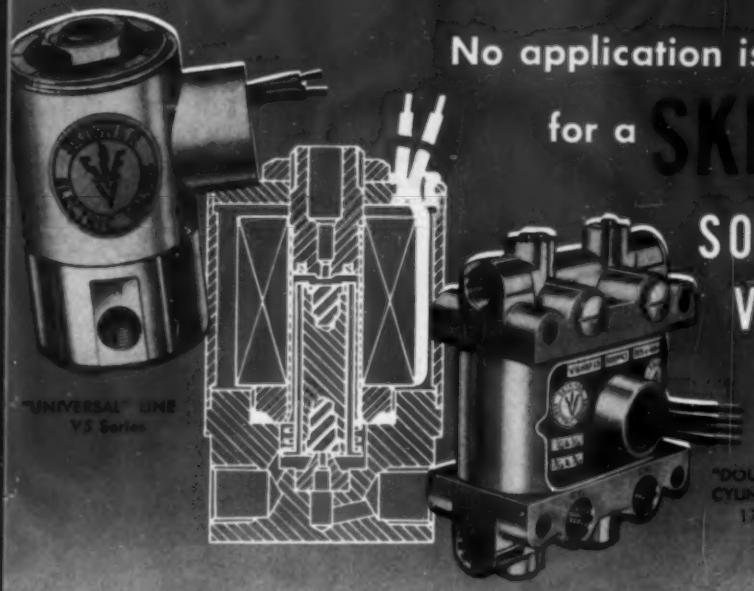
Circle 79 on Reader Service Card

Circle 91 on Reader Service Card

No application is too tough for a SKINNER SOLENOID VALVE!



These compact, rugged valves perform millions of cycles ...in countless applications

The V5 and the V9 are typical of the high-quality, small size valves which Skinner offers for general service applications. Both give fast, dependable operation and positive performance. Both are direct-acting, spring loaded, *leakproof*. And both of them are sturdily constructed . . . to give maximum service through long, severe use.

V5 - "Universal" Line

UL-approved — suitable for all common media on pressure or vacuum. Available in a broad selection of types, electrical outlets, port locations and sizes, flow adjustments and coil types. Also available with UL-approved Explosion-Proof construction and with "Quick Exhaust" for extra-fast cylinder return. *Simple to inspect* — can be disassembled without removal from the line.

Specifications: Type — 2- or 3-way, normally open or normally closed, or directional control. Pressure rating — 0-1000 p.s.i. Vacuum to 5 microns.

V9 - "All Purpose" Four-Way

For precision control of double-acting cylinders or two single-acting cylinders . . . at speeds up to 600 cycles per minute! Available with 176 variations of types, capacities and adjustable flow arrangements. Can be used with air, hydraulic, oils and other common media. Die-cast zinc bodies.

Specifications: Type — normally open, normally closed, or combination — normally open and normally closed. Pressure rating — 0-150 p.s.i. Vacuum to 5 microns.

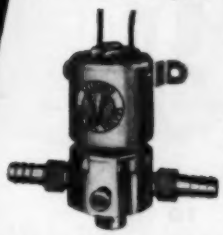
Do you have a solenoid valve problem? Call in a specially trained Skinner resident engineer— he'll tackle your problem immediately.

GENERAL SERVICE & VACUUM
V5 Series
2- & 3-Way
0-1000 p.s.i.

MINIATURE CUT-OFF
V2 Series
2-Way
0-250 p.s.i.

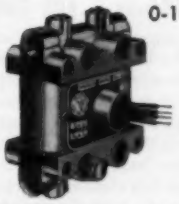
QUICK EXHAUST
(extra fast cylinder return)
QV5-3 Series
3-Way
0-150 p.s.i.

HI-PRESSURE HYDRAULIC
V10 Series
2- & 3-Way
0-1000 p.s.i.

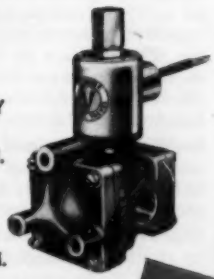


SANITARY
V4 Series
2-Way
0-20 p.s.i.

EXPLOSION-PROOF
X5 Series
2- & 3-Way
0-1000 p.s.i.



ALL-PURPOSE FOUR-WAY
V9 Series
4-Way 0-150 p.s.i.



HI-FLOW INDUSTRIAL
M Series
2- & 3-Way 5-150 p.s.i.

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Attention: Lift Truck Owners! Users!

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TO THIS!

A low-cost Greer Accumulator makes the big difference!

New Hydraulic Component Takes the Bounce and Jounce Out of Lift Trucks... *FOR GOOD!*

Shock and vibration is common to all hydraulically operated lift trucks. When a lift truck with a heavy load moves or stops suddenly, runs up a ramp, or travels over uneven ground, the bounce and jounce set up by the moving load leaves nothing but the vehicle and driver to absorb the tremendous pounding. The solution to this hazard is the *Greer Accumulator.* Its gas-filled bag cushions shock and vibration to harmlessness. And the money-saving benefits gained far outweigh its low cost in...

Reduced Spillage and Breakage! Fragile glassware, crated eggs, bags of cement — anything can be handled more safely. Less danger of costly delays and customer claims for damaged goods.

Improved Performance! Lift trucks move faster up ramps, over rough flooring and ground. Loads stay put. No bounce or jounce to shift crates.

Less Operator Fatigue! Driver rides more comfortably with closer control of direction and load. Work flows smoothly without slowdowns.

Longer Lift Truck Life! Less downtime, less maintenance when vehicle is rid of damaging shock. Parts last longer, perform better, too.

Learn how a simple pipe-tee and hose connects Greer Accumulator to system easily, quickly, and at low cost. Call or write your dealer for brochure.

GET ALL THE FACTS TODAY!
SEE YOUR LIFT TRUCK DEALER!

Manufactured by Greer Hydraulics Inc. · Jamaica 30, New York

U.S. Patents under Greer Licenses

Be sure your next lift truck is equipped with one!

LETTERS to the editor

Synchronizing Circuits

Do you have a diagram of a hydraulic system for a lift table with four or more cylinders with table coming up even, although the load is on one end?

R. W. HERMES
Walled Lake,
Michigan

A group of synchronizing circuits was published in the January 1954 issue of APPLIED HYDRAULICS. These have been sent to you. The hydraulic circuit alone will not assure proper operation of a large table. Design of supporting guide bushings is critical.

Swivel Fittings

We wish to obtain all available data on 1500 to 3000 psi equipment with specific interest in swivel fittings, to operate pressure through 150 degrees. Also information on pumps and valves for this service. May we also have a copy of your Data List and a copy of the JIC standards?

A. H. SMITH
Thompson Trailer Corporation
Pikesville, Maryland

Lists of suppliers of fittings, pumps and valves have been sent along with a copy of our Data List which offers a summary of literature in the fluid power field. To obtain the Standards please write to: Joint Industry Conference, Box 182, Northend Station, Detroit 2, Mich.

Paint Circulating Pump

Our company is looking for a small expendable vane type pump. We intend to use this pump to circulate paint through a heater under approximately 600 psi. The pump

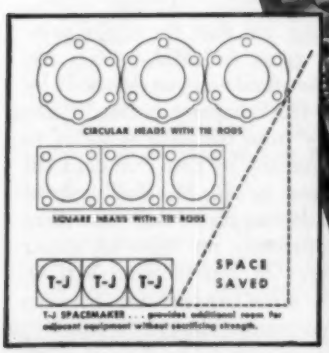
Continued on page 32

First in performance for automatic muscle jobs like these...

T-J

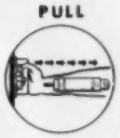
Spacemaker
CYLINDERS

OFF SHELF DELIVERY


CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
T-J
T-J
T-J
SPACE SAVED
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

PUSH

PULL



LIFT

- Raise
- Lock
- Brake
- Press
- Spin
- Turn
- Grind
- Weld
- Lower
- Squeeze
- Bend
- Coin
- Saw
- Tap
- Index
- Braze
- Open
- Time
- Blank
- Cut
- Breach
- Drill
- Sequence
- Close
- Snub
- Form
- Pierce
- Feed
- Mill
- Convey
- etc.

- **OIL pressure to 750—AIR to 200 P.S.I.**
- **New Compact Design . . . Saves up to 40% Space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Super Cushion Flexible Seals for Air . . . New Self-Aligning Adjustable Oil Cushion**
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- **The Only Cylinders with all the Extras as Standard**

T-J Spacemaker Cylinders get first call for an ever-widening range of power movement jobs in industry today—because they're so advanced in design . . . so efficient and dependable in performance. Wide selection of styles and capacities. Check your needs now! Send for bulletin SM-454-2. The Tomkins-Johnson Co. Jackson, Mich.

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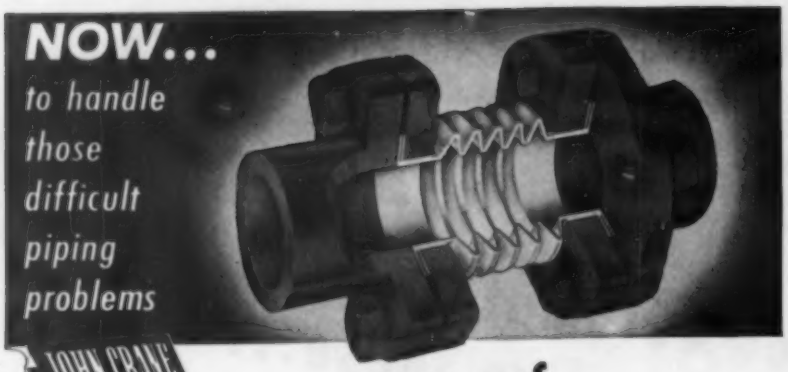
RIVETORS AIR AND HYDRAULIC CYLINDERS PUTTERS CLINCHERS

Member of the National Fluid Power Association



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Offers a complete line of

BELLOWS MADE OF TEFLON*

1 **Chemically inert**
—will handle all corrosive liquids, petroleum products, gases and solvents.

2 **Life-long flexibility**
—will not damage or fatigue under severe vibration or repeated expansion and contraction.

3 **Outstanding electrochemical properties**
—eliminate electrolysis in the handling of chemicals, acids, etc.

4 **Wide temperature range**
—flex perfectly and otherwise physically unaffected over a wide temperature range.

"John Crane" Bellows provide a positive answer in the transmission of any type hydraulic or lubricating fluid, including the newly developed synthetics. Impervious to practically all known corrosive liquids and gases, they are unaffected by temperatures from –300° to +500°F.

Made from a special densely molded stock and so machined that there is no inherent stress at their free length—*they expand and contract in either direction with equal freedom of motion.* End flanges of French-type gasket construction facilitate easy assembly and assure a leak-proof seal. Stock sizes are available in a full range of standard pipe dimensions from 1 to 8 in.

Bellows are also available in a wide range of designs suitable for metering pumps, pressure accumulators, batching scale connectors, etc.

Further information on Teflon parts and products is available in "John Crane's" 12-page illustrated catalog, "The Best in Teflon." Send for your copy now. Crane Packing Company, 1805 Cuyler Ave., Chicago 13, Ill.
In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

JOHN CRANE CRANE PACKING COMPANY

*DuPont Trademark for tetrafluoroethylene resin.

LETTERS to the editor

would only furnish enough pressure to induce flow through the closed high pressure circuit.

ERIC NORD
U. S. Automatic Corp.
Amherst, Ohio

We don't have an answer for this request. The life of any pump we are familiar with would be very short under the operating conditions of this job.

1955 N.I.C.H. Program

Will you let me have the information now available on the Eleventh National Conference on Industrial Hydraulics now scheduled for October 27-28 in Chicago? Our management is greatly interested in it even at this early date.

Z. C. VAN SCHWARTZ
Baldwin-Lima-Hamilton Corp.
Hamilton, Ohio

At this time we only know the dates and location of the N.C.I.H. meetings. They will be held at the LaSalle Hotel in Chicago. As in previous years, APPLIED HYDRAULICS will publish all program details as soon as they are available.

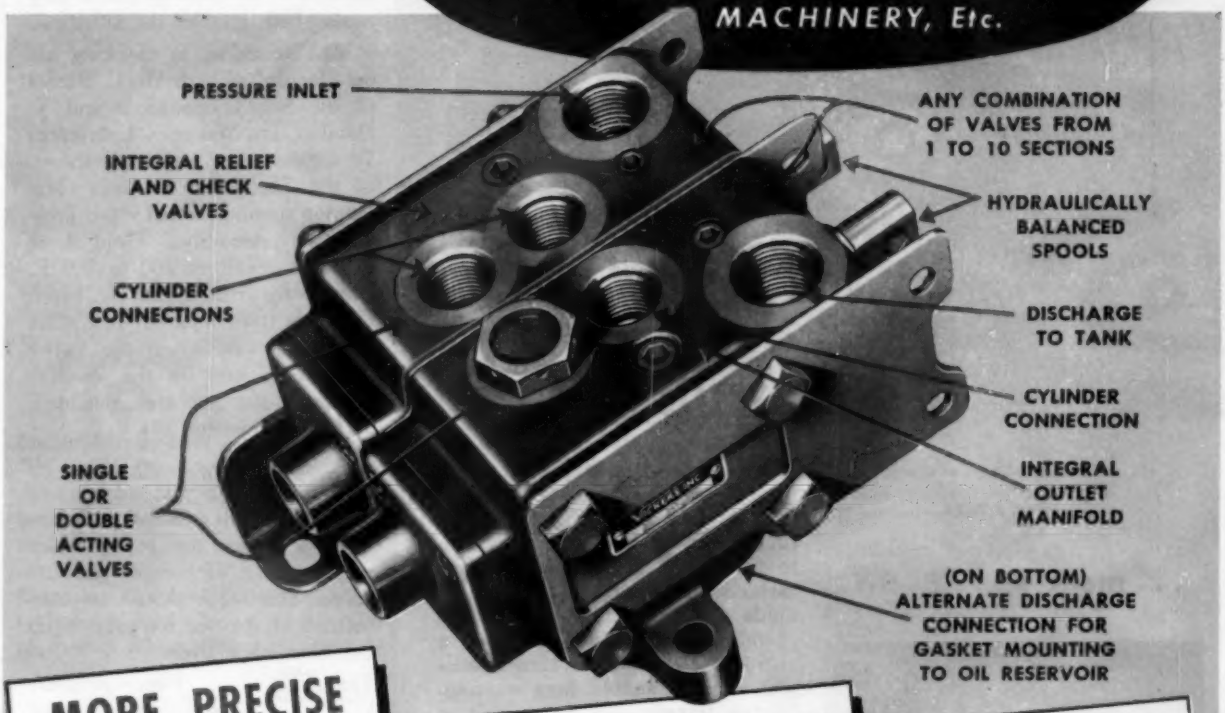
Correction for "Power in a Smaller Package"

After we ran "'Power in a Smaller Package' Evaluating of 5000 psi Hydraulic Systems" in the November, 1954, issue (pp 80, 82, 84, 86, 88, 90) we received a letter from George Ashman, Senior Test Engineer, Hamilton Standard Division United Aircraft Corp., pointing out that the vapor pressures given for MIL-O-5606 hydraulic fluid as established by Shell Oil Company differed quite widely from the data supplied to his company by Esso Standard Oil Co. and by R. M. Hollingshead Corp. He suggested that since there is apparently no limit on vapor pressure in Specification MIL-O-5606, some variation between

Continued on page 34

NEW! Series CM11 VICKERS® MULTIPLE UNIT VALVES

For MATERIALS HANDLING EQUIPMENT, FARM TRACTORS, BUCKET LOADERS, CONSTRUCTION and MINING MACHINERY, Etc.


PRESSURE INLET
INTEGRAL RELIEF AND CHECK VALVES
CYLINDER CONNECTIONS
SINGLE OR DOUBLE ACTING VALVES
ANY COMBINATION OF VALVES FROM 1 TO 10 SECTIONS
HYDRAULICALLY BALANCED SPOOLS
DISCHARGE TO TANK
CYLINDER CONNECTION
INTEGRAL OUTLET MANIFOLD
(ON BOTTOM) ALTERNATE DISCHARGE CONNECTION FOR GASKET MOUNTING TO OIL RESERVOIR

MORE PRECISE CONTROL
Improved Metering Characteristics

REQUIRES LESS SPACE
New Combination Operating-Valve and End-Plate Sections

LOWER COST
Simplified Design and Construction

New, compact, more versatile design of valve. End sections combine in one casting the inlet or outlet manifold plate together with any operating-valve section. Inlet section also contains relief valve. Individual outlet plates available for single unit valves. Single- and double-operating valve sections can be added between end sections as needed. Valve can be adapted for tandem (series) operation. Single-acting valves available for either direction of lever shift.

Other features include protection of pump from reverse flow during shifting . . . three point mounting for more simple installation . . . cylinder connections with ¾-16 N.F.-2 straight threads (AND 10050 type) which conform to SAE standards help insure leak-proof connections . . . optional outlet ports in end section so valve can be gasket mounted to the oil reservoir or pipe connected. Designed for use with Vickers Series V-200 Vane Pumps (up to 11 gpm), the CM11 Valve can be used up to 2000 psi working pressure. For further information write for Installation Drawing M168643.

6794

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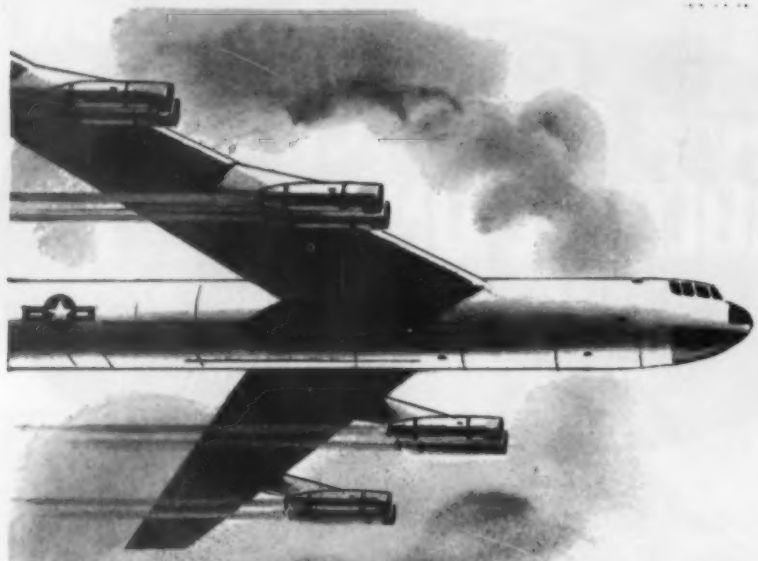
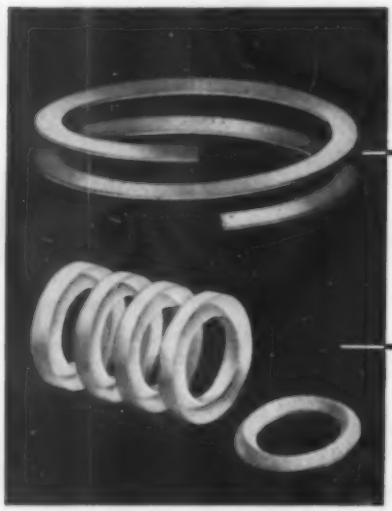
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



the Packings impervious to all hydraulic fluids

. . . made of *TEFLON*



Chemiseal hydraulic packings are made of pure duPont TEFLON to outlast other packing materials many times over. Chemically impervious, they have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Require no chemical inspection. Unmatched in anti-friction properties, tough, resilient, non-flammable, long wearing. Service temperature range is from minus 110°F to plus 500°F.

Try Chemiseal back-up rings that greatly lengthen "O"-ring life and prevent extrusion. Available in solid, split and spiral types in all commercial and AN sizes for "O"-ring packings, gaskets and universal fittings. Catalog OB-1152.

Try Chemiseal V-type packings for manual or automatically operated valves. Seal with low gland pressure and operating torque. Supplied with square-end TEFLON adaptors if required. Catalog TP-1053.

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CAMDEN 1, NEW JERSEY

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Representatives in principal cities throughout the world

LETTERS to the editor

manufacturers might be expected. However, he questions such an explanation of the large difference and asks that the source of information be checked.

We referred both Mr. Ashman's letter and his graph to Mr. Steinmetz. We also asked Esso Standard and R. M. Hollingshead if they could shed light on the situation.

Mr. Steinmetz, in checking his data, consulted both Mr. C. Daniel of the San Diego office and T. Dumlap, Jr., Manager, Lubricants Department, Los Angeles Division, of the Shell Oil Company. Mr. Dunlop supplied actual vapor pressures on Aero-Shell Fluid 4 at temperatures from 200 to 300 F. These were given in mm Hg. From the table it is apparent just what the error was. From the vapor pressure in mm Hg the absolute pressures and psi are calculated, as for example for 294 F,

$$\frac{30}{760} \times 14.7 = .58 \text{ psia.}$$

It is apparent that the error was in picking up the psf pressure value instead of the psi pressure value. This table should be used instead of the one on page 90 in the November issue.

Temp. F	*Vapor Pressure*		
	mm Hg	*PSF*	*PSI*
294	30	83	.58
272	17.7	49.2	.34
254	12.0	33.0	.23
230	6.6	18.2	.13
194	2.85	7.9	.06

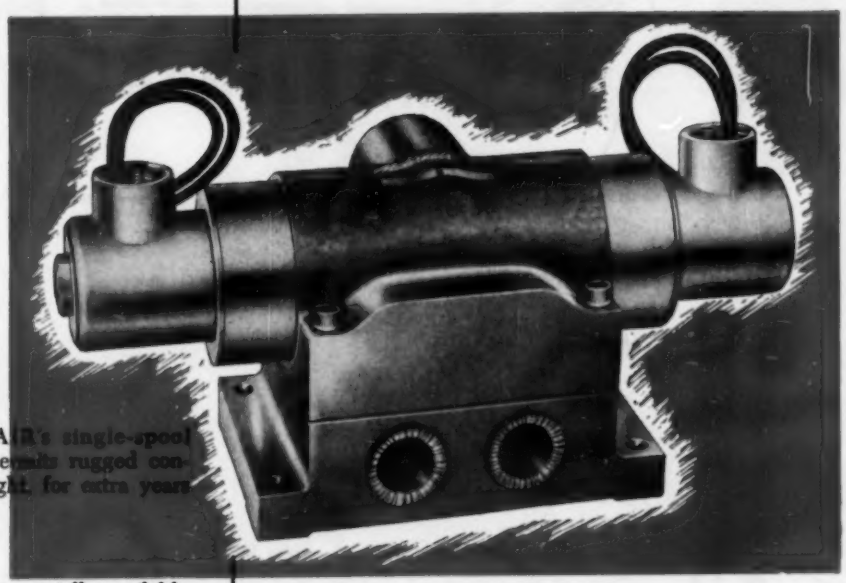
Mr. Steinmetz in forwarding this explanation, points out that this is "one of the many slippery errors which occur occasionally in the transfer of data."

Film List

APPLIED HYDRAULICS *has prepared a list of films covering pneumatics and hydraulics. This list briefly describes 48 available films and tells where each film may be loaned, rented or purchased. This film list will be sent free to readers requesting copies.*

Continued on page 36

Now - get these 5 money-saving benefits with *Modernair* MV Series Valves



1

Longer Service Life... MODERNAIR's single-spool design means fewer moving parts, permits rugged construction without excess bulk or weight, for extra years of reliable service.

2

Easier Maintenance... all seals are commercially available "O" rings, moving seals mounted on easily-removable sliding spool; can be replaced in a few moments with little disassembly.

3

Corrosion Resistant Construction... aluminum alloy body with hard drawn brass porting sleeve, aluminum alloy spool with oil-resistant synthetic rubber "O" rings.

4

Compactness... exclusive MODERNAIR design reduces bulk and weight, gives you maximum performance in minimum size (see photos for typical dimensions).

5

Versatility... available in ⅜" through 1" port sizes for air or oil hydraulic service to 200 p.s.i., in all popular mounting styles and operating types. Basic parts completely interchangeable—reduces inventory to a minimum!

NOW READY... NEW, MODERNAIR CATALOG
Gives complete dimension data, prices on MODERNAIR's full line of cylinders, valves, packaged fluid power devices. Write today for your free copy of this handy reference book.

SOLENOID OPERATED... single or double solenoid, in sub-plate (shown), or gasket mountings. ½" port size is only 9¼" long overall; 1" port size, 13¾" long.

PILOT OPERATED... in full pilot operated or spring return types, for gasket (shown), sub-plate or standard threaded-pipe mountings. Button bleeders may be mounted in end caps if desired. Only 5" long in ½" port size, 8¼" in 1" ports.

LEVER OPERATED... also available with foot pedal or treadle, or roller cam. Standard threaded pipe mounting shown, others available.

4

DEALERS, ATTENTION!... franchises open in some territories; write or wire now for MODERN-AIR'S profitable dealer plan.

Modernair Trademark **CORPORATION**
ROOM A4, 400 PREDA STREET, SAN LEANDRO, CALIFORNIA

FIRE-RESISTANCE

EASY MAINTENANCE

with UCON Trade-Mark Hydrolubes

safety hydraulic fluids

Ucon Hydrolubes are a *combination* of ingredients blended in balanced proportions for maximum safety, maximum efficiency, and easy maintenance—a synthetic lubricant, water, effective liquid and vapor phase corrosion inhibitors, special anti-wear agents, and an anti-freeze.

All these components add their beneficial properties to give Ucon Hydrolubes remarkable advantages: fire-resistance that has been proved both in the laboratory and in 7 years' industrial use . . . no harmful effects on packings and seals . . . high viscosity indexes (150 to 160) . . . low pour points (below minus 55°F.) . . . no toxicity problems.

Ucon Hydrolubes are supplied in viscosities of 200, 300, and 550 S.U.S. at 100°F.—and others can be made. There's a Ucon Hydrolube to do *your* job.

Remember: **SAFETY** *is no accident . . . return the coupon today.*

UCON Trade-Mark Hydrolubes *are products of . . .*

CARBIDE AND CARBON CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

Please send me the booklet "UCON Hydrolubes," Form 7380.

Name_____

Company_____ Position_____

Address_____

"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

LETTERS to the editor

Needs a Valve

Can you tell us where to buy a 3 inch 4-way solenoid or air operated valve. This valve is to be open center and operate at a maximum pressure of 250 psi. It must handle an emulsion of water in 10% rolling oil. The rolling oil is a mineral oil base with lanolin and fatty acids added. It has a pH factor of 7.85.

J. GRANT MEYERS
Grinnell Company
Toronto, Ontario

Sources for this valve have been suggested. Perhaps readers can supply additional information.

Fruit Juice Pump

Could you help us locate a manufacturer of a small, almost toy size hydraulic pump to be used to pump fruit juices in a vending machine which we manufacture? What we have in mind is a non-immersion type, capable of continuous duty whose capacity need not be over .5 gpm at a head of 1 psi.

A. J. DALLAS
The Opticraft Co.
Woodland Hills, Calif.

A list of several possible sources of supply has been sent.

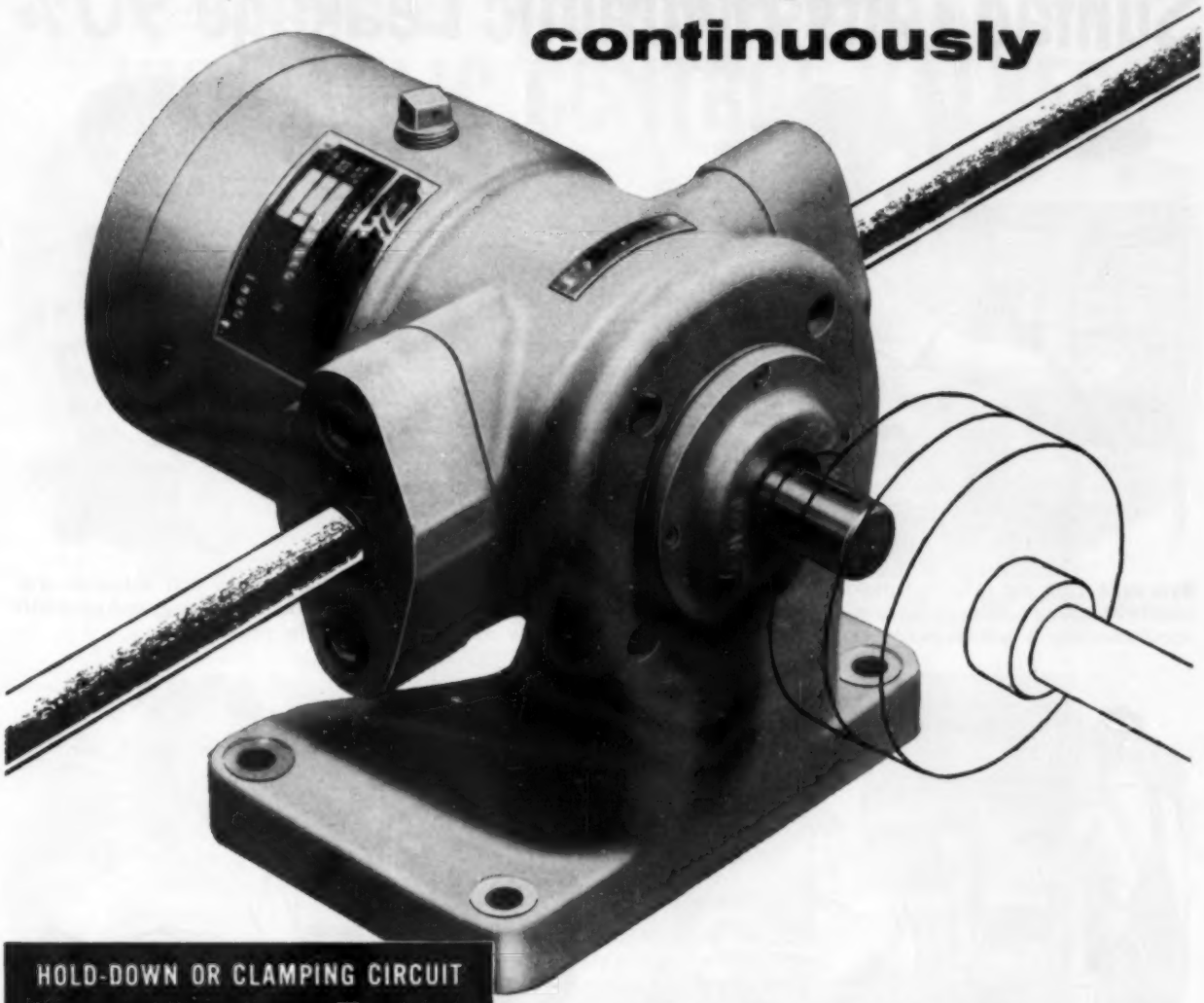
Component Application Sheets

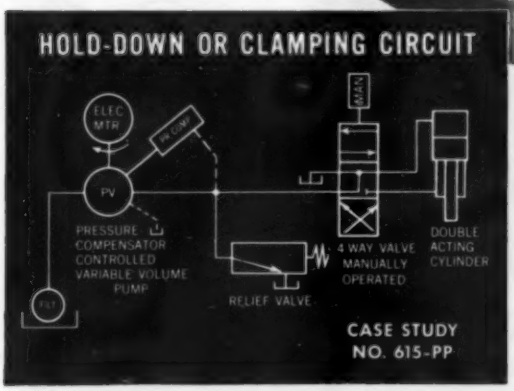
In the January 1955 issue, APPLIED HYDRAULICS published a 32 page section which concisely detailed air, oil and electrical components. Are reprints of this section available?

R. J. SMITH
General Electric Co.
Cleveland, Ohio

Yes, reprints in booklet form can be purchased. Single copies are 50 cents each. In quantities of 50 to 99 the price is 40 cents each; in quantities of 100 or more each copy costs 35 cents.

5000 psi— continuously





DENISON Hydr OIL ics

PUMPS • MOTORS • CONTROLS • PRESSES

Denison Axial Piston Pumps operate continuously at 5000 psi, deliver up to 35 gallons per minute

Few hydraulic pumps can operate at 5000 psi. And, if they can, it's for only a few seconds at 5000 psi. Not so with Denison Axial Piston Pumps. They deliver up to 35 gpm at 5000 psi . . . continuously. Yet they cost no more than many pumps with lower pressure ratings.

Three sizes deliver 10, 20 and 35 gpm. Available in constant or variable volume types . . . with handwheel, pressure-compensating, stem or cylinder volume controls. Mountings: Face, flange or foot.

The circuit shows a Denison Axial Piston Pump in a hold-down or clamping circuit. Write us for bulletins about Denison pumps.

THE DENISON ENGINEERING COMPANY
1166 Dublin Road • Columbus 16, Ohio

Suntac Cuts Hydraulic Leakage 90%

Hydraulic ram for injection molding press leaked excessively, using ordinary hydraulic oil. Make-up ran approximately 8 gallons per week.

Leaking oil dripped on hot platen and splashed onto operator, causing burns, spotted clothing, and generally untidy condition around the press.

Packings required changing at least once a month—frequent adjusting. Down time for maintenance seriously reduced productivity.

Changed to SUNTAC. Make-up oil now running only about ½ gallon per week. Operators are happier, and productivity greatly increased.

If you have a leaky hydraulic system, remember this: SUNTAC is the hydraulic oil especially compounded to reduce leakage. Special additives make the droplets cling together . . . keep them from leaking through packings. Experience has proved that SUNTAC will cut leakage an average of 35%. Get complete information about SUNTAC Hydraulic Oil from your Sun Oil Co. representative. Or write Dept. AH-4.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline

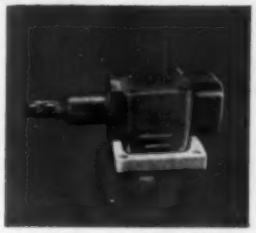
Double A's WIDE LINE OF HYDRAULIC CONTROL VALVES

Offers you...

EXACT VALVE ACTION REQUIRED WITH FEWER VALVES AT LOWER COST

- ★ PIPE SIZES: ¼" THRU 2"
- ★ OPERATING PRESSURES: MODELS FOR 2000 P.S.I.–3000 P.S.I.–5000 P.S.I.
- ★ MOUNTING TYPES: CONNECTIONS IN BODY, SUB-PLATE MOUNTING, FLANGED CONNECTIONS

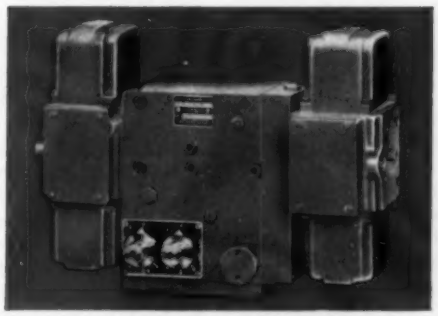
RELIEF VALVES



BY-PASS VALVES (for sequence and unloading applications)

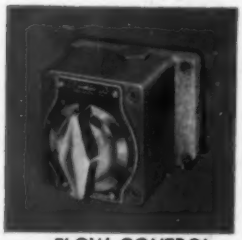
BY-PASS and CHECK VALVES (for counterbalance and sequence applications)

REDUCING VALVES



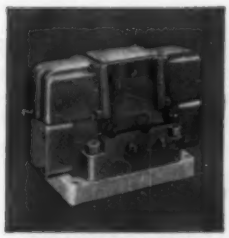
TRAVERSE and FEED CONTROL PANELS

REDUCING and CHECK VALVES



FLOW CONTROL VALVES

DIRECT SOLENOID VALVES



SOLENOID CONTROLLED PILOT OPERATED VALVES

WRITE FOR NEW FULL LINE CATALOG
OR CONTACT YOUR LOCAL REPRESENTATIVE

Double A PRODUCTS CO.
MANCHESTER, MICHIGAN

CALIFORNIA
The Ruston Co.
Oakland-Olympic 3-3221
Los Angeles-Kimball 8271

COLORADO
Alta Engineering Co.
Denver-Empire 8-3557

GEORGIA
J. A. Postell
Atlanta-Atwood 8671

ILLINOIS
Walter Norris Engineering Co.
Chicago-State 2-2804

INDIANA
TEC Engineering Corp.
Indianapolis-Walnut 3-8538
Logansport-3305
Muncie 2-7735

LOUISIANA
Sintes Sales Engineers
New Orleans-Canal 2882

MARYLAND
Cauliflower, Inc.
Ellicott City-871

MASSACHUSETTS
The James Stewart Company
Amherst-1320
Brookline-Beacon 2-8980

MICHIGAN
J. N. Fauver Co., Inc.
Detroit-Temple 2-4115
Flint-Cedar 5-5392
Grand Rapids-8-1247

MINNESOTA
H. U. Roggeen, Inc.
Minneapolis-Geneva 1045

MISSOURI
Lynn Elliott Co.
Kansas City-Victor 2197

Oscar E. Jost Co.
St. Louis-Prospect 3-4790

NEW JERSEY
The Aireyal Company
Maplewood-So. Orange 2-1701

The Battersby Co.
Trenton-Export 3-5350

NEW YORK
The Aireyal Company
New York-Cortland 7-9614

R. C. Neal Co., Inc.
Buffalo-Mohawk 1110
Elmira Heights-5168
Rochester-Glenwood 8380
Syracuse-75-9911

OHIO
Lax Industrial Products Inc.
Cleveland-Wyoming 1-7700

Hydraulic Power Equipment Co.
North Lima-Kimball 9-3717

Scott Equip. & Eng. Co.
Cincinnati-Main 9540
Columbus-Walnut 4697
Dayton-Kenmore 1140

J. N. Fauver Co., Inc.
Toledo-Waterville 3598

OKLAHOMA
Lee Johns Co.
Tulsa-6-1335

PENNSYLVANIA
Erie Industrial Supply
Erie-2-3231

The Battersby Corp.
Philadelphia-Radcliffe 5-7760

Weinman Pump & Supply Co.
Pittsburgh-Walnut 1-7705

TEXAS
Lynn Elliott Co.
Dallas-Sterling 1140
Houston-Charter 4715

VIRGINIA
Cardwell Machine Co.
Richmond-7-2985

WASHINGTON
The Ruston Co.-Seattle

WISCONSIN
C. L. Thompson
Milwaukee-Hilltop 4-4817

OUTSIDE CONTINENTAL U. S. CONTACT:
International Sales Division
New York Airbrake Company
New York, New York
Phone: Worth 4-3580

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

MOISTURE, OIL SEPARATOR . . . A new heavy-duty, high-capacity moisture, dirt, and oil separator for compressed air lines and equipment is announced by Beach Precision Parts Co. The new model, No. 125 S, is for 125 cfm, 100 psi operation and sells for less than $100. The unit is for ½-inch connections and is designed to handle 2 million or more cubic feet of compressed air without change of filter elements. Additional information is available from the company.

Circle 125 on Reader Service Card

VALVE . . . using the "shear-seal" principle is explained graphically in a comic book style publication prepared by Barksdale Valves. The book illustrates the construction of the valve which has the advantages of leakproof closure and long service life without maintenance. The valve permits gradual throttling, and its sealing qualities improve with each operation.

Circle 126 on Reader Service Card

ELECTRIC MOTORS . . . The Lima Electric Motor Co. has published a new service brochure which lists the names and addresses of authorized Lima service stations, representatives and factory distributors throughout the country. Also included is a guide to information that will enable customers to obtain prompt and efficient service.

Circle 127 on Reader Service Card

WATER ADDITIVE . . . A special lubricating and rust preventing additive developed by E. F. Houghton & Co. for use in closed water hydraulic systems is explained in a technical bulletin. Called "Hydrolubric," this additive will provide lubrication throughout the entire hydraulic system. It prevents rust and pitting of metal surfaces, helps reduce wear, power loss and water loss and increases packing life. It aids pump and valve performance and assures smoother operation of equipment.

Circle 128 on Reader Service Card

CYLINDERS . . . featuring interchangeable mountings, self compensating packings, and adjustable cushioning are described in Bulletin IC-2.3 offered by National Pneumatic Co., Inc. and Holtzer-Cabot Divisions. The cylinders are designed for 200 psi air or 500 psi water or oil service (non-shock). Single-end rod and double-end rod models are available in stroke lengths of 1-inch increments. Built-in lubrication eliminates the need for external line lubricators. A special applicator strip on the piston head continuously adsorbs the lubricant through capillary action, and deposits a film on the cylinder wall.

Circle 129 on Reader Service Card

U-RINGS . . . made from synthetic rubber, natural rubber, or silicone rubber are listed in a brochure issued by Dowty Seals Ltd. The material is selected to suit the application. Inquiries should specify the nature and pressure of fluids and the maximum and minimum temperatures. Illustrated suggestions and design information are included.

Circle 130 on Reader Service Card

AIRCRAFT HYDRAULIC PUMPS . . . are specified in bulletin 320 by Eastern Industries, Inc. Included is the 1700 series pump which is a small and light line of pumps for delivering small, accurate volumes of fluid against high pressures when operating at high speeds. Displacements in this series run from .00419 to .025 cubic inches per revolution. The pumps can be driven at speeds up to 10,000 rpm and are designed to meet the rigid requirements of the aircraft industry.

Circle 131 on Reader Service Card

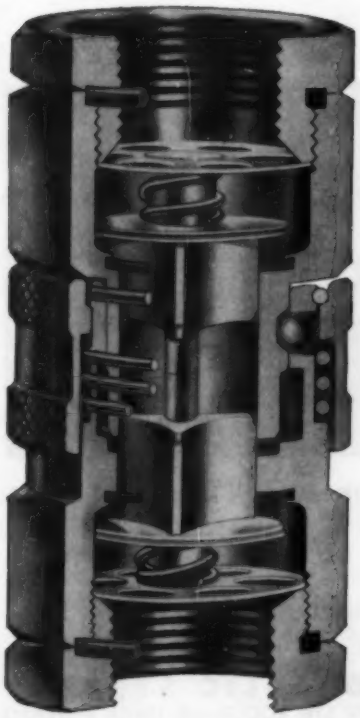
TIME DELAY RELAY . . . which can be adjusted to drop out in ½ to 6 seconds is described in Publication 555 of the Automatic Switch Co. The relay may be used with motors having a brake winding to disconnect the brake after a selected time. The relay may also be used to disconnect solenoid valves ½ to 6 seconds after it is energized.

Circle 132 on Reader Service Card

For more reviews of Free Literature turn to page 95

DISCONNECTED IN 1 SECOND

and NO DANGEROUS SPRAY



INSTALL SNAP-TITE "H" COUPLINGS:

- Snap-Tite "H" Series couplings are constructed so that the valve is completely closed in coupler before disengaging the nipple seal, eliminating fluid spray, and the only loss of fluid is the few drops in the nipple cavity.
- Powerful springs keep valves shut tight when "H" couplings are disconnected.

Check your couplings. Are they creating accident hazards and losing costly fluids? Are offensive odors and flammable gases escaping from them?

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

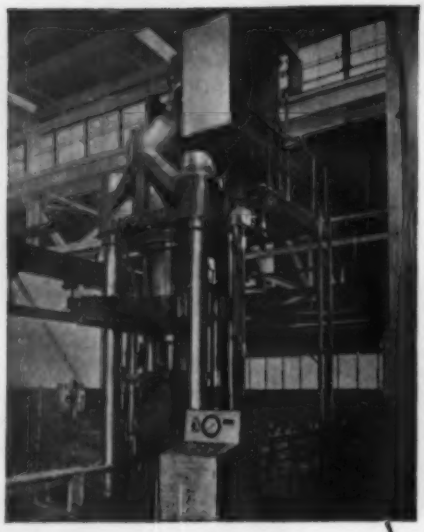
Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—these combine to allow maximum flow capacity with lowest pressure drop.

Available in sizes ⅛" to 10" in alloy steel or to specifications

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

See the Snap-Tite representative in your city or write for Bulletin 240A

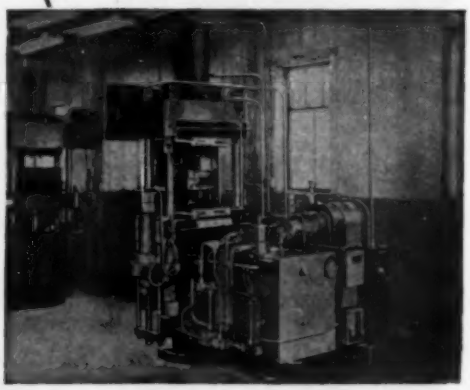
Snap-tite, INC.
UNION CITY 1, PENNSYLVANIA



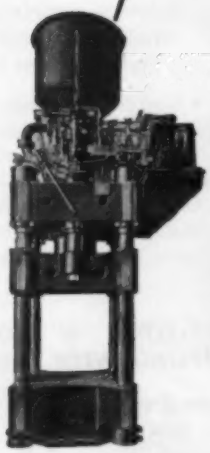
ROBERTSON EXTRUSION PRESS.

All over N.America you will find
ELECTRAULIC HIGH SPEED PUMPS
AND AUTODRAULIC CONTROL VALVES

BIRDSBORO PRESS PRODUCING CORRUGATED ROOFING.



LOGAN INJECTION MOULDING PRESS.



HYMAC PULP BALING PRESS

All over North America Electraulic All-Hydraulic high speed pumps and Autodraulic control valves are giving consistent and unfailing performance over a wide range of applications. A direct hydraulic system powered by Electraulic pumps and operated by an Autodraulic control system (no solenoids) is an independent unit, unaffected by the demands of other machines, giving any desired pressure at fingertip control—it cannot fail to give increased efficiency and economy in your plant.

ELECTRAULIC
REGD TRADE MARK
HIGH SPEED PUMPS

DIRECT HYDRAULIC SYSTEM
TOWLER BROS (PATENTS) LTD. RODLEY. NR. LEEDS. ENGLAND.
Sole Agents U.S.A. and Canada
MACMILLIN ENGINEERING CORPORATION,
HOWARD STREET, CHICAGO 45, ILLINOIS • Ambassador 2-1191
TR.42.

You win

on every draw at Summerill

Particularly when it comes to seamless steel tubing. For our modern, versatile plant is completely equipped to produce almost any type of cold drawn seamless tubing you may require—and produce it to *your* specifications. What's more, every Summerill tube is drawn to a smooth, bright surface, unusually free from pits, die scratches and scale—thanks to our step-to-step quality control and close inspection.

Our research, production and sales service groups will welcome the opportunity to show you how you can make a better product at less cost with Summerill Seamless Steel Tubing. And it may surprise you to discover how quickly our closely knit organization can move from problem to production. • Write today for free booklet listing typical sizes, shapes and specifications of Summerill Tubing. Address:
Summerill Tubing Division, Columbia Steel & Shafting Company, Pittsburgh 30, Pa.

Summerill

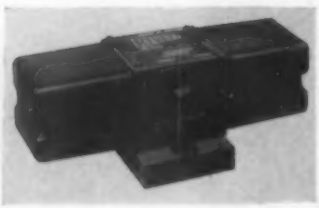
District Offices

BUFFALO • CHATTANOOGA • CHICAGO • CLEVELAND
DAYTON • DETROIT • HARTFORD
MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH

HYDRAULIC TUBING • SPECIAL TUBING • MECHANICAL TUBING • DIESEL TUBING • PRESSURE TUBING • AIRCRAFT TUBING

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.



SOLENOID VALVE
. . . requires low current

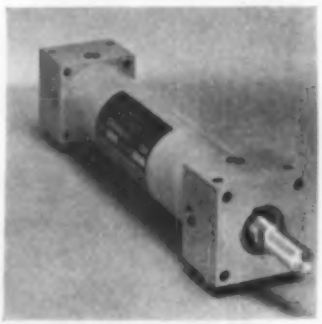
Designation: Series 6500

Design: Solenoid-controlled, pilot-operated valve is furnished with double or single solenoids. The double solenoid type is available as no-spring, two-position; or spring-centered, three position. Roomy wiring box with terminal strip is dust sealed and provides ½-inch conduit connections on each side of the valve. The valve is sub-plate mounted for panel installation. Seven spool designs are available for any circuit control.

Features: The heavy continuous duty, shock mounted solenoids provide long life and low power consumption. Solenoids operate on 3.6 amperes inrush current and .45 amperes holding current at 115 volts.

Specifications: Valve is designed for 3000 psi and flow capacity is rated at 3.6 gpm at 15 ft per sec. Furnished in ¼-inch size.

Rivett Lathe & Grinder, Inc.
Boston, Massachusetts
Circle 175 on Reader Service Card



AIR CYLINDER
. . . for universal mounting

Designation: U-series

Design: Cylinder uses single screw thread method of attaching cylinder heads to barrel providing an extremely strong and compact design which requires minimum mounting area.

Features: Four different mounting types—foot, front flange, rear flange, and clevis—are incorporated in one cylinder without the use of bolts, screws, brackets, mounting plates, etc. This gives a more rigid installation and avoids assembling these parts before installation of the cylinder. The cylinder may be used in a later installation as a different type of mounting without the purchase of additional brackets. The cylinder heads may be rotated with respect to each other to locate the pipe ports or mounting pads at any position desired.

Specifications: Bore size of 1⅛, 1⅜, 2, 2½, and 3 inches are available.

Pathon Manufacturing Co.
Cincinnati 12, Ohio
Circle 176 on Reader Service Card

ELECTRIC MOTOR
. . . is totally enclosed

Designation: Type J

Design: Motor is designed more compactly than previous types, and the same horsepower is provided in less space. Improved methods of manufacture and superior materials have resulted in higher electrical characteristics and closer tolerances. No general disassembly is required to gain access to the bearings. Frame is solid cast structure, heavily ribbed around the entire unit for added strength and rapid heat dissipation. Conduit box can be rotated to any of four positions. Ball bearings permit thorough purging of old grease.

Specifications: Motor is available from 1 to 10 hp, in fanless type from 1 to 1½ hp.

Applications: Engineered for operation where fumes, dusts, and moisture are present. The externally exposed surfaces are of cast iron for corrosion resistance.

U. S. Electrical Motors, Inc.
Los Angeles, Calif.
Circle 177 on Reader Service Card

Continued on page 46

It's the BALANCED Synclinal DESIGN

SUMP TYPE (Cutaway)

LINE TYPE (Cutaway)

that makes MARVEL SYNCLINAL FILTERS AMERICAN INDUSTRY'S A-1 CHOICE

In the plants of America's industrial giants, as well as in smaller plants, Marvel Synclinal Filters are installed on all types of hydraulic and other low pressure liquid circulating equipment. Marvels are chosen because of their excellent performance in protecting machines and increasing production by reducing down time. They are proving again and again, their superiority in the one real test—ON THE JOB! The BALANCED Synclinal Design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage space for filtered out particles—therefore, longer periods of productive operation are attained at the absolute minimum of maintenance. They meet J. I. C. Standards.

EASY MAINTENANCE—Both sump and line type filters may be easily disassembled, thoroughly cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

Not only plant operators, but also, OVER 550 ORIGINAL EQUIPMENT MANUFACTURERS have recognized the superiority of Marvel Synclinal Filters and now install them as standard equipment.

VISIT OUR EXHIBIT BOOTH #802
at the
6th National MATERIALS HANDLING EXPOSITION
International Amphitheatre
CHICAGO, ILLINOIS
May 16-20, 1955

**SPECIFY MARVEL SYNCLINAL FILTERS ON NEW EQUIPMENT--
STANDARDIZE WITH MARVELS ON EXISTING EQUIPMENT**

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

FILTERS FOR NON-FLAMMABLE HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of non-flammable hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.

625 W. JACKSON BLVD., CHICAGO 6, ILL.
PHONE: FRANKLIN 2-4431 & FRANKLIN 2-3530

Without obligation, please send me complete data on Marvel Synclinal Filters as follows:

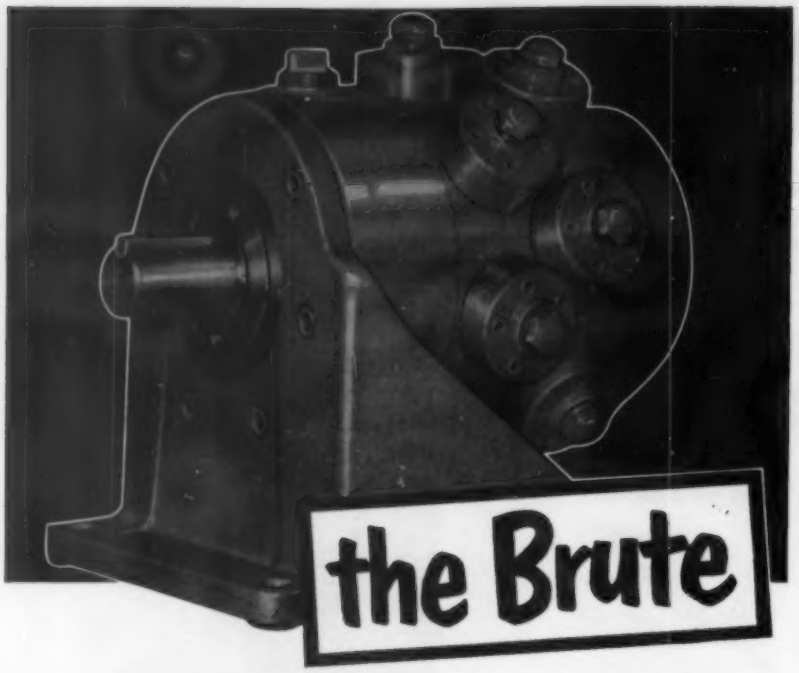
Catalog No. 106 for Hydraulic Oils, Coolants, Lubricants — AH-4
Catalog No. 300 for Water
Data on filters for non-flammable hydraulic fluids

Name _____ Title _____

Company _____

Address _____

City _____ State _____



This Series C SECO heavy duty pump has been aptly termed the "Brute" of all hydraulic pumps. The Brute is the rugged, revolutionary answer to high horsepower, high pressure demands. It opens new horizons in the use of oil hydraulic power.

Pressure is developed *within hollow pistons*—a patented feature of SECO pumps—making possible extremely high pressures without loss of mechanical efficiency. Each piston assembly is completely surrounded by high pressure lubrication and literally floats in a hydrostatic film of oil during its power stroke. *Fluid timed* ball check valves insure quiet and efficient operation at all pressures.

The Brute is at present made in two models, with the following characteristics:

MODEL	C-11	C-5
MAX. PRESSURE-SPOT RATING—PSI	5,000	10,000
MAX. PRESSURE-CONT. RATING—PSI	4,000	6,000
DELIVERY AT MAX. PRESS. G.P.M.	10	5
SPEED.....R.P.M.	1170	1170
H.P. INPUT AT MAX. PRESSURE	35	38

If you are interested in high horsepower, high pressure hydraulic power, please send for complete information on SECO Series C Pumps.

Simplex Engineering Co., Zanesville, Ohio

SECO

SIMPLEX ENGINEERING CO.
Zanesville, Ohio

Please send me complete information on SECO Series C pumps.

Name_____ Title_____

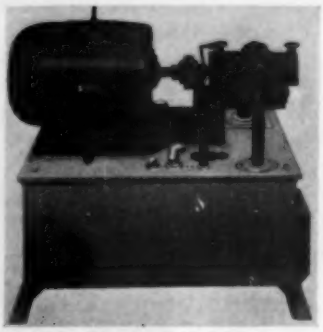
Company_____

Address_____

New Products / continued

RESERVOIRS
. . . have fitted accessories

Designation: TK tanks

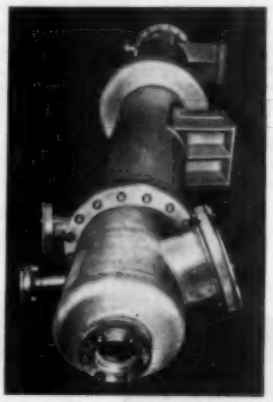


Features: Reservoirs have large mounting area and have fittings, pipes, breather, filler cap, gaskets, etc. mounted. This simplifies assembly of a specific power unit. Power units can also be assembled with customer's components.

The Rosean Co.
St. Clair Shores, Michigan
Circle 178 on Reader Service Card

HEAT EXCHANGERS
. . . custom made

Features: Production of these units has been set up to provide shipment within two or three weeks. Numerous optional design features may be specified to meet



a wide variety of heat-transfer problems. Nozzles, for example, may be of any size or at any location required by the installation. Units may be specified with or without an expansion joint. They have been designed for pressures of 150 psi and higher. Construction details meet ASME Code specifications.

Downingtown Iron Works, Inc.
Downingtown, Pennsylvania
Circle 179 on Reader Service Card

Continued on page 49

FOR THE FIRST TIME...

LINEAR, with a new, automatic process, now brings you ROTO-MOLDED "O" Rings—precise, compression-molded quality, at mass production costs!

This high speed, instrument-controlled process is exclusive with LINEAR. It produces uniformly cured perfect circle rings with flash-free finish, pre-stretched grain structure, and complete freedom from contamination by foreign inclusions.

WHY SPECIFY LINEAR ROTO-MOLDED "O" RINGS?

Because they provide greater molded-in strength and wearing properties at a cost comparable to ordinary "O" rings. Moreover, LINEAR ROTO-MOLDED "O" Rings are dimensionally stable and compounded to *fit the job*.

LINEAR ROTO-MOLDED "O" Rings are mass produced . . . available for quick delivery in a variety of sizes and materials to meet the exact needs of your application.
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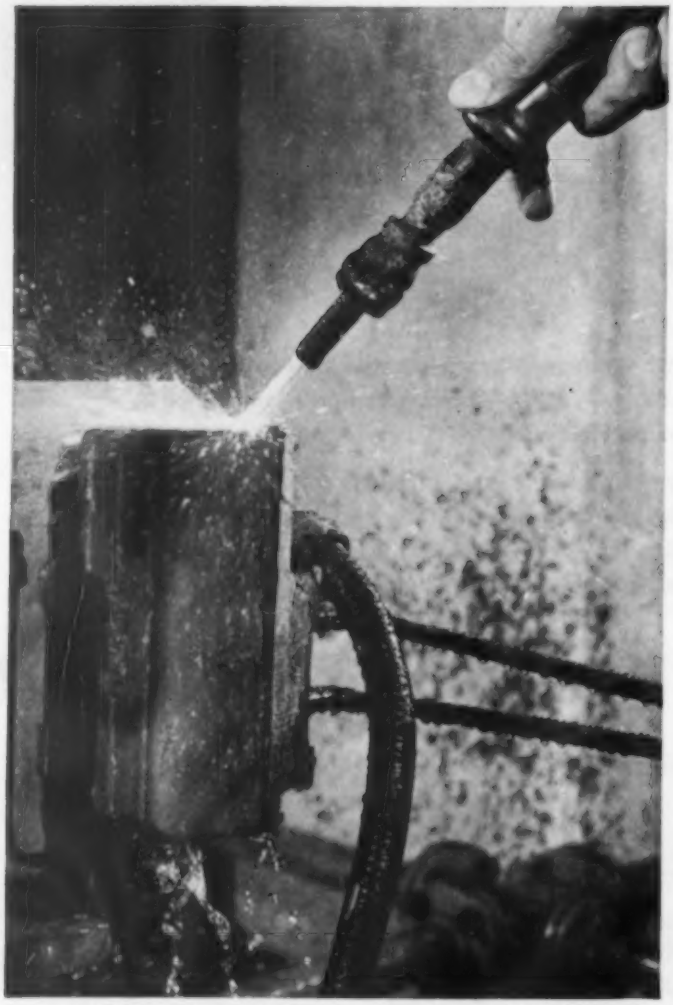
LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

SHEDS WATER LIKE A DUCK'S BACK!



A BATH A DAY doesn't affect this solenoid air valve. It's a MAC with a sealed cover—and it's been operating under conditions like this at Corn Products Refining Company for two years without a hitch.

Spray away! This solenoid-operated air valve is waterproof. For over two years at the Corn Products Refining Company, Argo, Ill., it's been used to operate the cylinders that empty starch vats. There, where everything must be kept spotless, it's been hosed down regularly along with a battery of identical MAC air valves. And, unlike the ordinary type that had been on the job before, not a single MAC has failed to operate perfectly . . . none has *ever* needed maintenance.

Originally built to special order, MAC valves with gasket-sealed covers are now standard in many sizes. They protect both the solenoid and valve mechanism against dirt and dust, as well as moisture . . . making them ideal for foundries, food processing plants, or wherever grit, oil, coolant, water and the like play havoc with valve operation.

If you have an application that requires a *superior* air control—sealed or not—telephone a MAC representative listed at the right.

You'll find all MAC controls simple in design, compact, easy to service without touching the piping. You'll find MAC valves cost less . . . perform better . . . last longer than any air control you've ever used, too. Telephone your representative or write for free literature.

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Michigan

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PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

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SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., Kimball 8271

ILLINOIS
CHICAGO 43—Mechanical Air Controls, 10336 South Western Ave., Hilltop 5-3640

INDIANA
FORT WAYNE 3—Neff Engineering Co., P. O. Box 2001, Station A, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS—Jack Neff, 42nd St. Station, P. O. Box 7361, HUmboldt 6421
SOUTH BEND—Dick Futter, 103 South Varsity Dr., 2-4856

MASSACHUSETTS
BOSTON 34—Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., STadium 2-7440

MICHIGAN
BAY CITY—Fred Kober, 506 Chilson St., 2-2629
FLINT—Kober Sales Engineering Co., 514 Beach St., CEdar 8-5123
GRAND RAPIDS—Kober Sales Engineering Co., 190 Monroe Ave., GLendale 4-3252

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FIlmore 5579
ST. PAUL 14—W. H. Schulz Co., 2438 Franklin Ave., Midway 2744

MISSOURI
ST. LOUIS 14—Oscar E. Jost Co., 10920 St. Henry, HArrison 8-4488

NEW YORK
BUFFALO 21—C. H. Topas Co., 200 Washington Hwy., Circle 3210
NEW YORK 7—C. H. Ribble Co., 261 Broadway, WOrth 4-6227

OHIO
CINCINNATI—The R. W. Nichols Co., Fidelity Federal Savings Bldg., 2087-9 Sherman Ave., Norwood, ELmhurst 2440
DAYTON—The R. W. Nichols Co., 407 Realty Bldg., Michigan 4724
OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, BErea 4-1379
TOLEDO 4—The R. W. Nichols Co., 510 Manhattan Bldg., MAin 8623
YOUNGSTOWN 3—The R. W. Nichols Co., 202 Schwenn-Wagner Bldg., Riverside 4-4550

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DALLAS 19—Womack Machine Supply Co., 6409 Maple Ave., Dixon 6997

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MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN

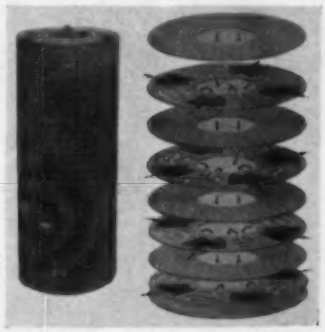
MAC

New Products continued

OIL FILTER CARTRIDGE ... with large filtering area

Designation: Type F-718, Type FW-718

Design: Filter cartridge is designed for low pressure drop and high dirt storage capacity. The density of filter paper used results in removal



of particle sizes down to 5 microns. The degree of initial particle size removal can be controlled by use of special papers and other materials. Cellulose cartridge is suitable for filtering mineral oils or heavy duty detergent oils without removing the detergents and oxidation inhibitors. Two types permit different methods of installing.

The Hilliard Corp.
Elmira, New York

Circle 180 on Reader Service Card

AIR REGULATOR ... for precise control

Designation: Model 55

Design: Regulator is compact, lightweight, and rugged. It may be panel, bracket, or line mounted. Valve spring is stainless steel; dia-

phragm, Nylon and Buna N; body, cast aluminum chemically treated for corrosion resistance. Unit is furnished with or without pressure gage.

Features: Automatic relief valve is actuated if the regulated pressure exceeds the preset value. Efficient water separation, as well as improved over-all performance and reduced maintenance, are accomplished by a large capacity dripwell and resinous bonded filter element 35 times the area of standard ¼-inch pipe. Entire unit is easily cleaned and dripwell is drained by a simple pushbutton valve.

Specifications: Size is 3⅜ inches diameter by 7⅛ inches high with adjusting screw fully extended. Maximum flow capacity is 15 cfm, maximum inlet pressure is 150 psi.

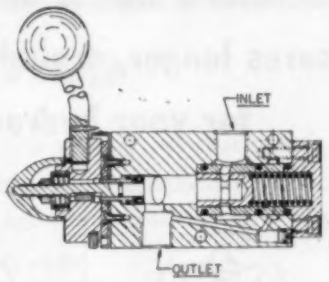
Kendall Controls Corp.
Waltham, Mass.

Circle 181 on Reader Service Card

FLOW CONTROL VALVE ... for frequent speed changes

Designation: Model No. 1407-4

Design: Valve handle has 180-degree rotation with adjustable tension to eliminate need for wrenches or locking levers. Flow rate changes



are easily made under any condition of pressure or back pressure. Valve is lightweight with aluminum body and steel working parts.

Features: Regulated flow is controlled within 10% of the calibrated rate with pressure drops from 75 to 3000 psi.

Applications: Controls flow between .5 and 20 gpm. Selection of handle rotation permits one man to control two operations simultaneously.

Waterman Engineering Co.
Evanston, Illinois

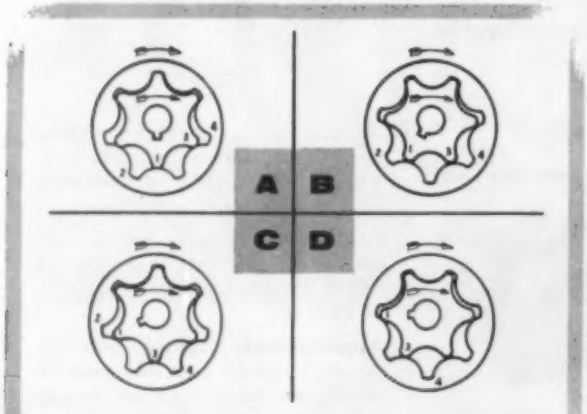
Circle 182 on Reader Service Card

For more NEW PRODUCT reviews turn to page 102

Gerotor Hydraulic Pumps are...

Designed to take it!

Gerotor's simple design and sturdy construction assures longer, trouble-free life for your hydraulic system!



The two Gerotors revolve at different speeds, resulting in a continuous opening and closing of the spaces as shown in this diagram. Follow the changing position of tooth #1 as rotation takes place. Note its relation to space #2. As rotation continues, tooth #1 gradually displaces oil from space #2, thus creating pressure. The outer rotor of the Gerotor principle is designed with one tooth more than the inner rotor, with fluid-tight contact at all points. As a result, low tooth sliding velocity is achieved.

Friction is the basis for all wear . . . Gerotor's exclusive rotor design cuts friction to a minimum. The Gerotor principle . . . heart of every Gerotor pump . . . is represented by a pair of gear-shaped elements, one within the other. Power is applied through the shaft to the inner Gerotor and is transmitted in the closed mesh region to the outer Gerotor.

Each tooth of the inner Gerotor is in sliding contact with the outer Gerotor at all times, providing continuous fluid-tight engagement at very low contact speed. The contact points revolve only once in seven to nine revolutions, depending on the type of unit. ***This reduced friction permits higher shaft speeds, assures longer life.***

Due to high production facilities, Gerotor can produce special pump designs in *quantities* at an amazingly low price. Whatever your hydraulic pump problems, bring them to Gerotor.

FREE literature available . . . write:

GEROTOR MAY CORPORATION

1535 Maryland Avenue . . . Baltimore 3, Maryland

packings with a *plus*

Over the years our engineers have been calling this *plus* the "P-F-M Factor" which boils down to this:

Packings—Fluids—Metals . . .
all three . . . must be *compatible* for maximum hydraulic efficiency!

For example, when each is selected to work best with the others you get longer service from hydraulic equipment, freedom from excessive maintenance, smooth precision operation that lowers costs.

So standardizing on Houghton VIM and VIX-SYN Packings gets you *plus service* no other packings offer:

Packings that are right for the job because we make all types and sizes

Fluids compatible with their seals . . . we developed both as a "team"

Metallurgical experience with ferrous and non-ferrous metals used as hydraulic components

Ask the Houghton Man to fill in details on the *plus service* we're talking about. He has a copy of the latest general bulletin, "Packings by Houghton", and data on new standards. See him, or write *E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.*

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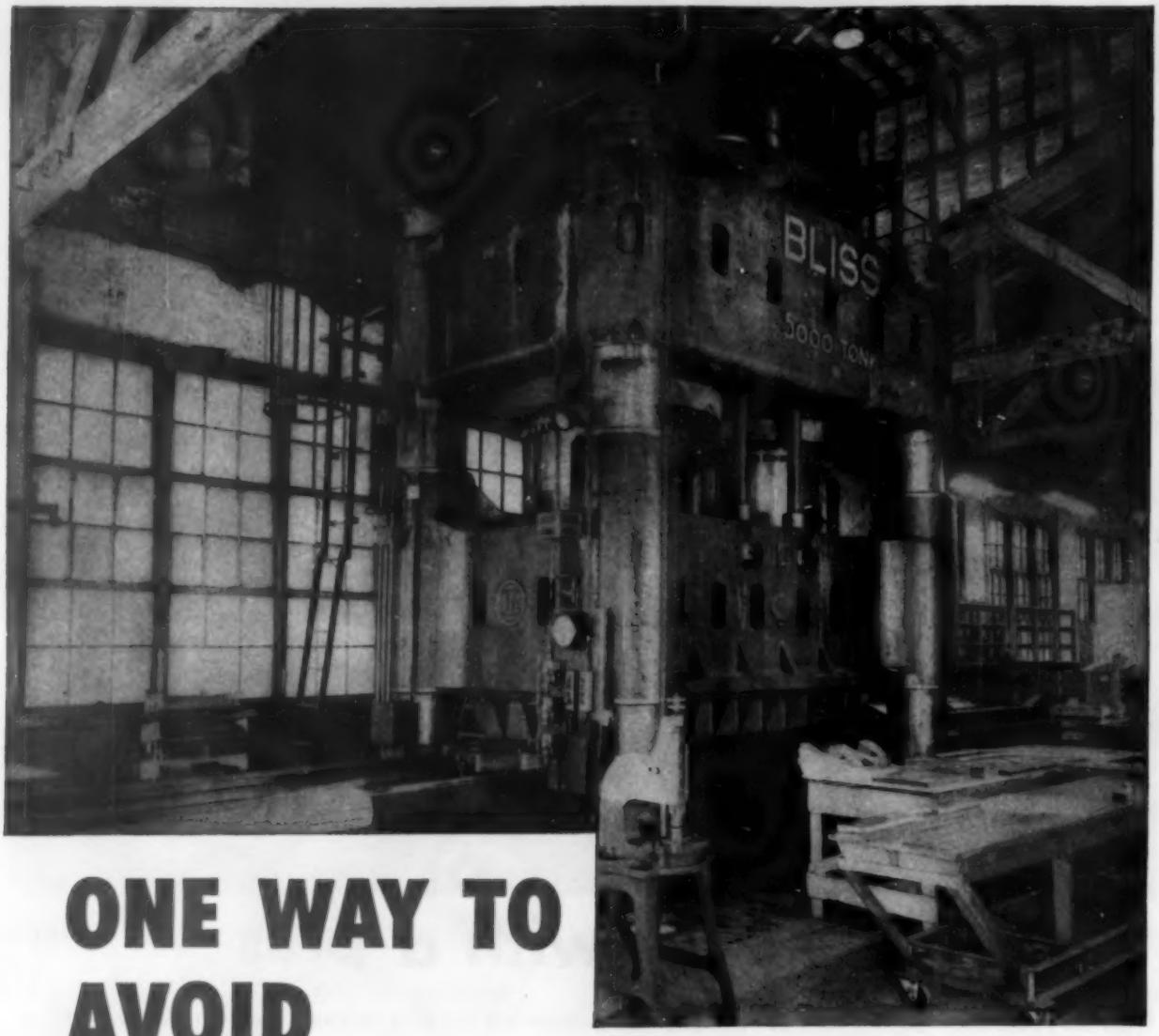
Ready to give you on-the-job service . . .



ONE WAY TO AVOID DOWNTIME

KEEP hydraulic systems free from sludge, rust and foam. You'll never have to worry about unscheduled stoppages due to hydraulic fluid when you use *Texaco Regal Oil R&O* —the oil that has *more than ten times the oxidation resistance* of regular turbine-quality oils.

Texaco Regal Oil R&O provides an ideal medium for transmitting power, effectively lubricates internal moving parts, stands up under high temperatures and agitation. Your hydraulic equipment will run smoothly and pumps and other parts will last much longer.

From the largest hydraulic presses to the smallest hydraulic controls, *Texaco Regal Oil R&O* will assure dependable, efficient, low-cost operation. There is a complete line of *Texaco Regal Oils R&O* to meet every requirement. Leading makers of hydraulic equipment recommend their use—many ship their units already filled with *Texaco Regal Oil R&O.*

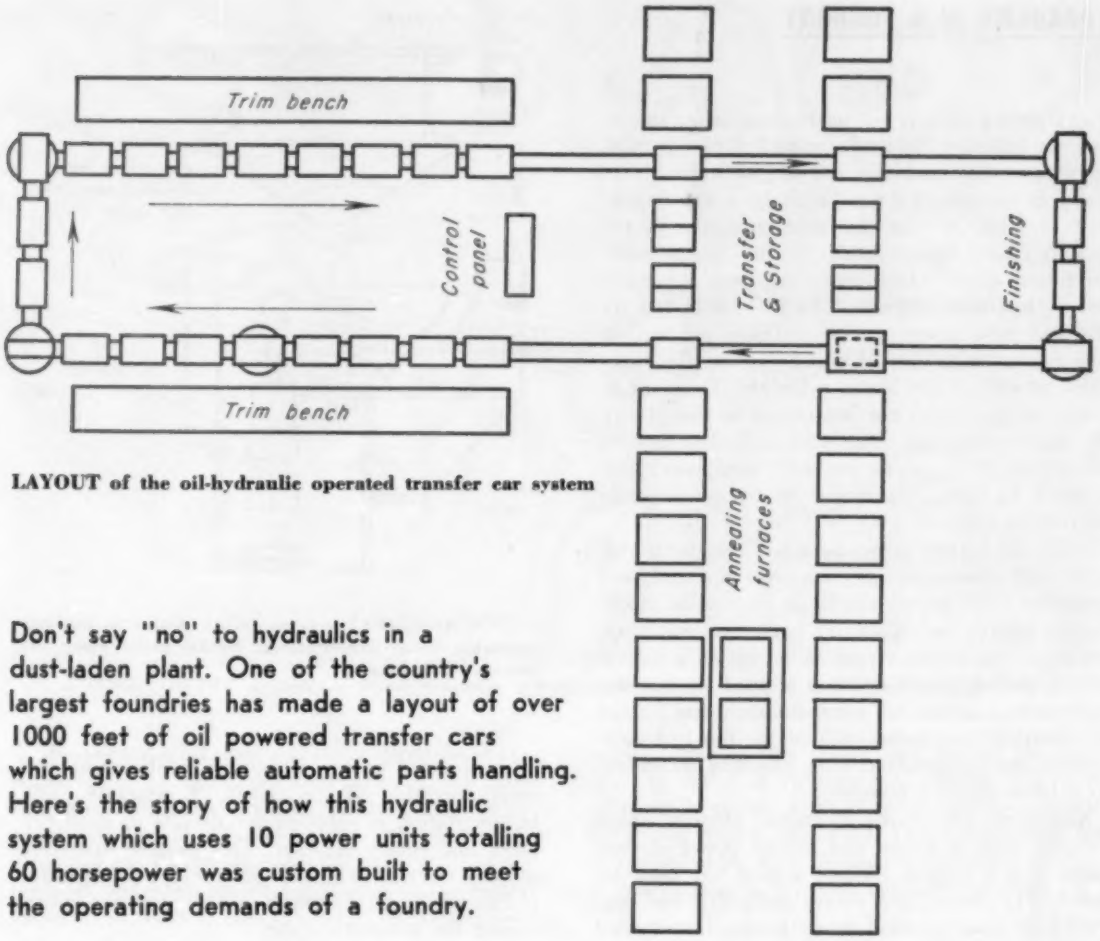
Let a Texaco Lubrication Engineer help you get better performance from all your hydraulic mechanisms. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL HYDRAULIC UNITS

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE or DONALD O'CONNOR on television . . . Saturday nights, NBC.



LAYOUT of the oil-hydraulic operated transfer car system

Don't say "no" to hydraulics in a dust-laden plant. One of the country's largest foundries has made a layout of over 1000 feet of oil powered transfer cars which gives reliable automatic parts handling. Here's the story of how this hydraulic system which uses 10 power units totalling 60 horsepower was custom built to meet the operating demands of a foundry.

Tunnel located hydraulic system powers . . .

AUTOMATIC PARTS HANDLING

FACED with the job of increasing speed, reducing manual effort and providing safer, more efficient movement of castings from the trim bench to the annealing furnace, National Malleable and Steel Castings Company, Cleveland, has made an installation of oil powered track mounted shuttle cars. The company consulted the Jeffrey Manufacturing Company, which designed and built this oil-hydraulic transfer car system.

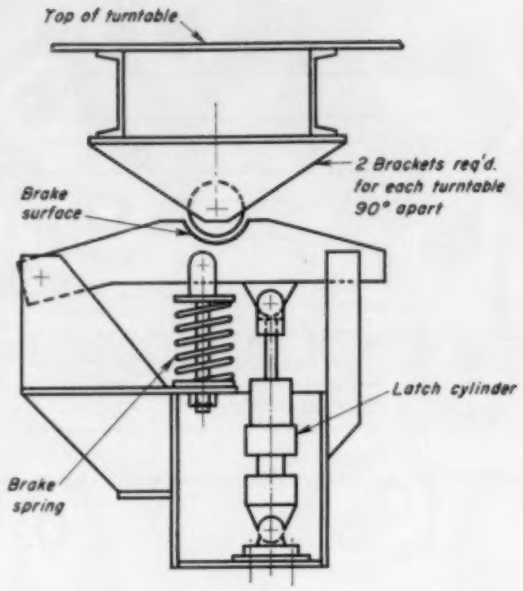
Dust and space limitations were two factors which had to be carefully considered. There is probably no other industry which is faced with such a sand and dust problem. Without proper protection, sand will get into the oil causing erratic operation and damage to packings. To protect the hydraulic components and working mechanisms and at the same time utilize the available space to best advantage, it was decided to install the complete hydraulic power system underground, in a tunnel running below the car tracks.

This car system, which has been operating successfully for two years, consists of 27 cars running

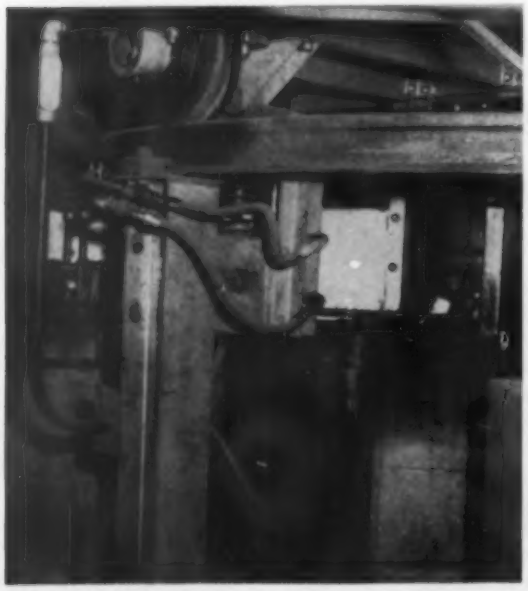
on straight tee rails, layed out in rectangular shape. Each car takes a 6 ton load. On each corner is a 90 degree turntable, and one 180 degree turntable is located in one side of the rectangle by a trim bench. Each of these 10 foot diameter turntables is rotated by rotary torque actuators. Ten pusher racks and tilting spurs, which move the cars, are operated by hydraulic cylinders. Each cylinder has its own hydraulic power package. There are ten of these power units, five of which operate the turntables as well as the linear cylinders. The electric motors in the system are interlocked so that if any one motor stops, the other nine will also stop. It is also possible to operate any individual power unit by itself. In normal operation the ten power units run continuously.

While the system is in operation, the linear cylinders will advance the cars one space at a time, and turntables will operate clockwise or counter-clockwise to receive and discharge cars. Automatic operation of the entire system is set up at a central control station. Limit switches tripped by transfer movements maintain the automatic sequence. Except for electrical interlocks, each of the ten hydraulic circuits are independent. One complete automatic cycle takes about 5 minutes.

Analyzing one of the hydraulic circuits which includes both a linear and rotary power device, shows that a rugged efficient system has been selected. The linear and rotary cylinders are controlled by three position 4-way solenoid controlled pilot operated valves. Provision is also made for hand operation of the circuit. A separate push-button station is supplied for control of each cylinder and rotary actuator. This permits operation of each valve individually and enables the operator to line up the entire system in case of power failure during the automatic cycle.

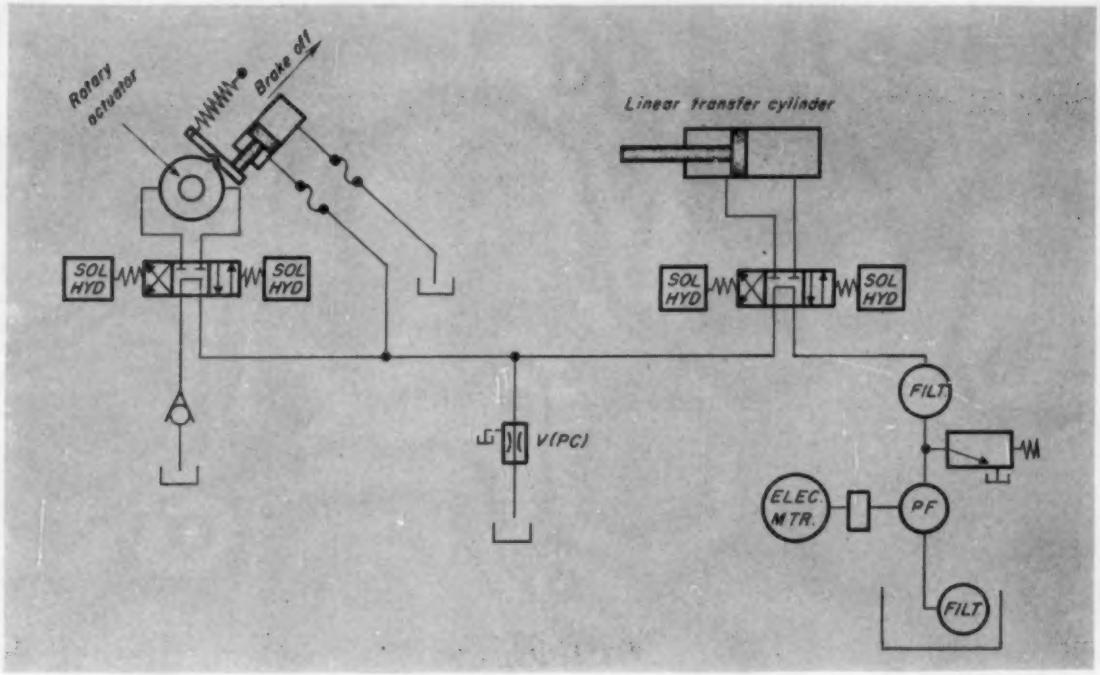


LATCH ASSEMBLY acts as safety device to prevent turntable from overrunning. Brake locks when oil pressure is released.



EACH TURNTABLE is actuated by the rotary torque actuator and is fitted with a hydraulic brake release device.

TEN OF THESE power units operate the linear and rotary cylinders. About 350 gallons of oil fill the entire system.



THIS CIRCUIT operates a linear transfer, a turntable actuator and a brake release cylinder.

The same circuit also operates a latch assembly which stops the turntables from overrunning their 90 degree turn. Each turntable has this safety device which consists of a brake release cylinder and a brake spring. The spring holds the latch in the brake position, and when pressure is applied to the rotary actuator, pressure is also applied to the release cylinder, retracting the piston and freeing the turntable to make its 90 degree movement. Whenever pressure is removed from the turntable actuator, the spring applies the brake. This occurs when the turntable control valve is deenergized and in neutral. This arrangement provides fail-safe operation.

▼▼▼

MAIN CONTROL CABINET contains all starters, pushbuttons, selector switches and control relays. Each station can be operated separately.

TRANSFER CAR carrying 6 tons of castings will be discharged from this turntable after its 90 degree turn.

ROTARY FLUID MOTORS drive each Turntable around the stationary die in the center.

On a new stretch-wrap forming machine

MOTION AND FORCE FLEXIBILITY

is achieved with hydraulics

When a blacksmith hammered and bent a metal piece, he worked the metal around a stationary anvil. His work depended on his skill, strength, and freedom of movement. Putting this strength into an oil powered machine is "old stuff". But designing equivalent freedom of movement and skill into a machine is something new. This new stretch-wrap forming machine achieves freedom of motion by applying a hydraulic drive to rotate the stretching arms around a stationary die.

FIG. 1. BY LIFTING stretching cylinders to maximum height, Carousel forms sheets up to 22 inches wide. Jaws can be changed to handle sheets or spars.

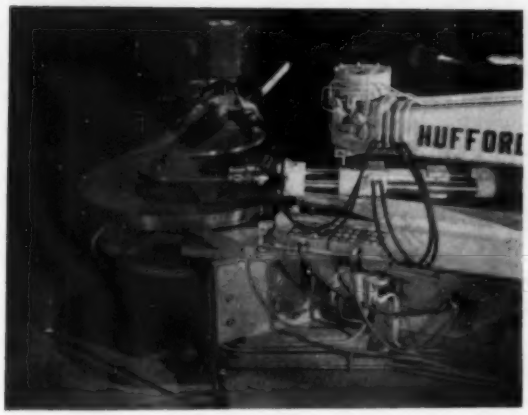


FIG. 2. WORK IS stretch-wrap formed using auxiliary table-mounted cylinders and one rotating arm. Second rotating arm is equipped for simultaneous roll forming. This second tension cylinder is traversed end-for-end to apply force against joggle blocks. This develops sharp corners in the work.

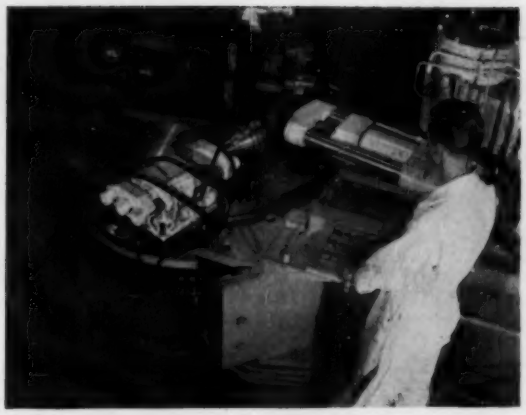


FIG. 3. CAROUSEL MAKES simple work of complicated reverse bend. Arms start from 180-degree position with work suspended between two die halves. Each arm simultaneously rotates under independent control to form both halves of the part.

FIG. 4. REVERSE bend is formed by using stationary cylinder as bulldozer. Part is forced into center position of die by male form block. Arms then stretch-wrap in opposite directions completing the contour.

A NEW hydraulic stretch-wrap forming machine, called the Carousel, because the operator rides on one of the rotating arms, provides great flexibility of operation. The machine is capable of producing many parts formerly requiring several different machines, as well as all conventional parts from both extrusions and sheets up to 22 inches wide.

The Carousel designed and built by the Hufford Machine Co. consists of a stationary die mounting table and two rotating arms on which are mounted the stretching cylinders and jaws. The arms rotate 360 degrees permitting formation of circular shapes, and the height of the stretching cylinders is adjustable to permit formation of helical shapes. A novel feature is the inclusion of a third cylinder and jaw which can be bolted to the stationary die table at any desired extension. This cylinder is free-swiveling in a horizontal plane, and its primary use is to grip one end of the work while one of the rotating arms grips the other end. A roller may then be mounted on the remaining arm to give a wiping action on the work. The machine can perform bulldozing, joggling, stretch-straightening, reverse bends, and "S" curves.

An electrically controlled hydraulic system permits great versatility of the Carousel. The cylinder brackets are positioned along the rotating arms by lead screws driven by hydraulic motors. The arms are rotated by separate hydraulic motors through worm gears, and the speed and direction of the arms are controlled by valves. The pressure supplied to the stretching cylinders is selected by valves. The hydraulic controls are actuated from two control

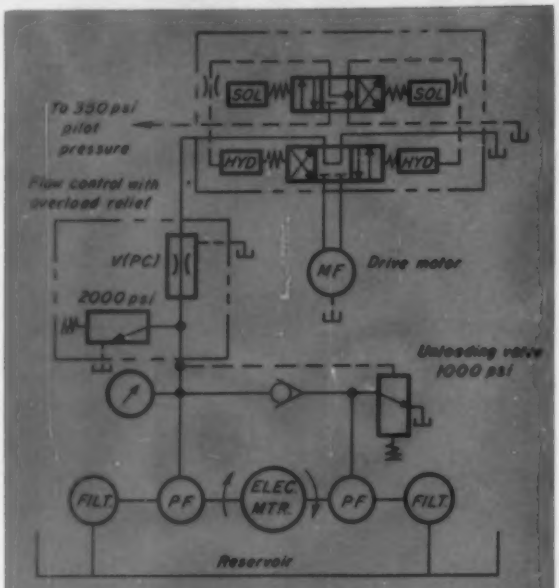


FIG. 5. ARM DRIVE CIRCUIT—4-way, three-position valve controls direction of flow to drive motor. Flow control valve regulates speed of motor.

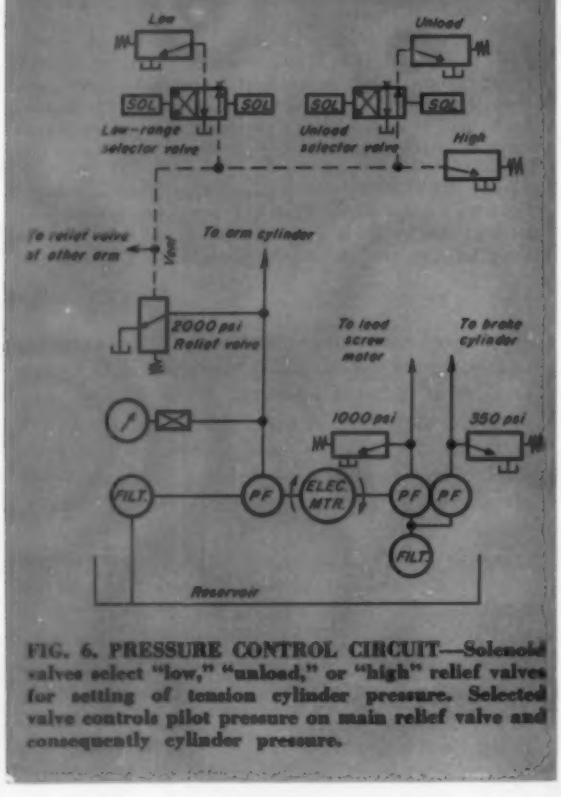


FIG. 6. PRESSURE CONTROL CIRCUIT—Solenoid valves select "low," "unload," or "high" relief valves for setting of tension cylinder pressure. Selected valve controls pilot pressure on main relief valve and consequently cylinder pressure.

panels—one for each arm. The control panels can be mounted on one arm so that one operator can control the machine, or they can be mounted on each arm for two-man operation.

The arm drive motor circuit for each arm is illustrated in Figure 5. Direction of flow to the drive motor is controlled by the 4-way, three position solenoid controlled-pilot operated valve which permits driving the arm in either direction and stopping it at any position. The speed of the drive motor is controlled by the flow control valve which has a built-in relief valve set at 2000 psi.

This meter-in circuit which uses a pressure compensated flow control with the integral overload relief permits operation at pressures determined by the load and limited to the overload relief setting of 2000 psi. Two pumps are used to form a "hi-lo" circuit so that at loads requiring less than 1000 psi, a combined volume of 35 gpm is available to the motor. Of course the flow control valve has to be opened to permit this flow. When setting up the machine, use of both pumps permits rapid rotation of the arms. At 1000 psi, one pump unloads, so that working fluid is then taken from only one pump.

The maximum torque of the rotating arms is 1,350,000 inch-pounds at a speed of ½ rpm. The vane-type drive motor develops a maximum torque of 2400 inch-pounds at a pressure of 2000 psi and drives the arm through a gear ratio of 563 to 1. The motor has a displacement of 7.56 cubic inches per revolution and a speed of 550 rpm at 18 gpm.

The pressure control circuit, Figure 6, illustrates the method of selecting the pressure supplied to the stretching cylinders. Pressure setting of the main relief valve is determined by the pressure in the vent line. This pressure is varied by pilot relief valves. Three are used. One for low pressure range, one for high, and one for unload. The unload pressure is used to move the cylinders during loading and unloading of the work. Selection of the unload, low range, or high range pressure is made by the 4-way, two position solenoid valves. The circuit is shown with the unload pressure selected. Actuation of the low-range selector valve and unload selector valve to the left-hand positions permits selection of pressure in the low range. The "low" relief valve is then adjusted for the desired cylinder pressure as indicated on the gage. To select a pressure in the high range, the solenoid valves are actuated to disconnect the "low" and "unload" valves. This leaves the "high" valve for adjustment of the cylinder pressure.

By presetting the cylinder pressure, slow hand adjustments during forming are eliminated. After setting up the machine at unload pressure, the operator has only to press pushbuttons to select the preset pressure. For stretching, the pressure in both stretching cylinders and the auxiliary cylinder on the die table is set at once. For wiping, the pressure control for each cylinder on the rotating arms is independent. ▼▼▼

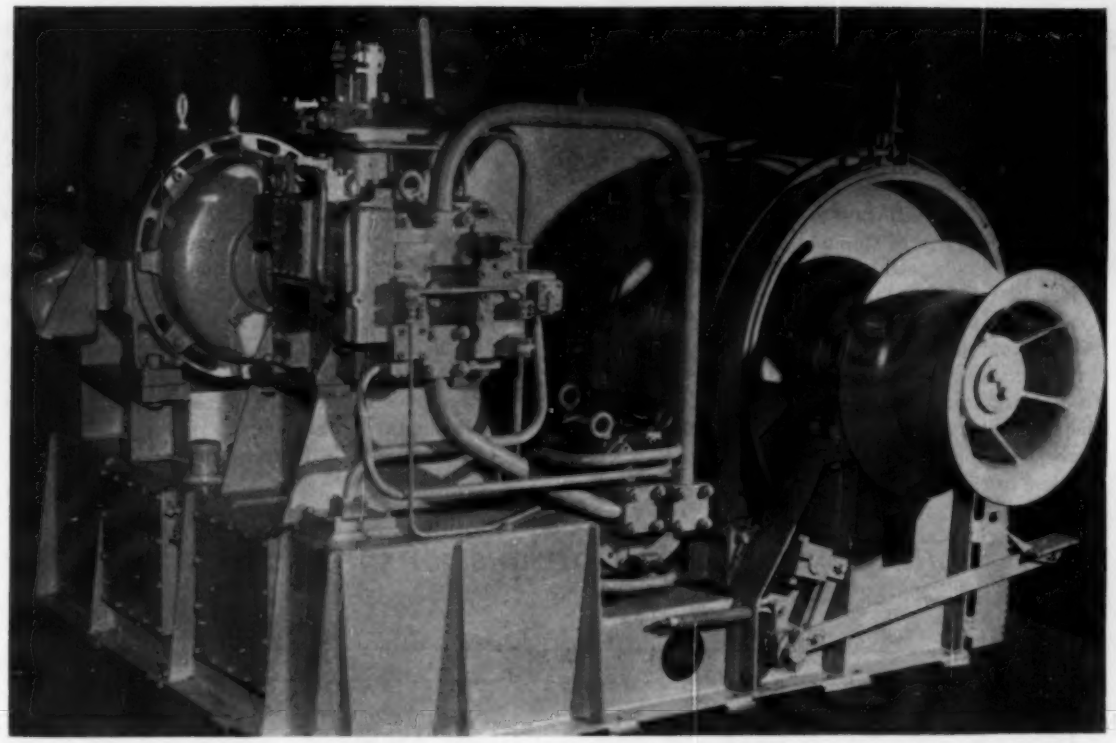


FIG. 1. THIS WINCH, one of 56 installed on two refrigeration ships will handle loads as follows: a. 11,000 lbs at 160 fpm, b. 7,400 lbs at 220 fpm, c. 0 to 1850 lbs at 400 fpm.

Hydraulic drive for a marine winch offers many advantages—

- *Faster load handling*
- *Increased useful operating time*
- *Greater safety*
- *Lower power consumption*
- *Less weight and space*
- *Explosion proof*

VARIABLE SPEED TRANSMISSION DESIGN

. . . for cargo hoist applications

• By E. C. Milde

REDUCTION of cargo loading and unloading time from ships is resulting from the use of oil powered winches. With the average ocean-going cargo ship spending more time in port than at sea, handling time is a major factor in meeting the competition of other types of carriers.

To help reduce turn-around time in port, ship operators are, among other things, looking to improve the efficiency of their cargo handling machinery. To this end, they are turning to oil hydraulic equipment to operate this machinery, particularly to the highly versatile variable speed hydraulic transmission. The results of the application of hy-

E. C. MILDE, *Hydraulic Design Engineer, Waterbury Tool Div. of Vickers Inc., Waterbury, Conn.*

draulic equipment to the materials handling problem of cargo vessels are proving most encouraging.

Use of variable speed hydraulic transmissions to drive these cargo winches has resulted in many improvements. First of all, and even with the same maximum line speed as that used with previous drives, the hydraulically operated winches handle loads much faster. This is due to their ability to accelerate and decelerate smoothly at a very high rate. Previously used drives required an appreciable time to accelerate and decelerate so that, with a limited distance to travel, deceleration often had to begin almost as soon as acceleration had been finished, with no time to run at steady line speed.

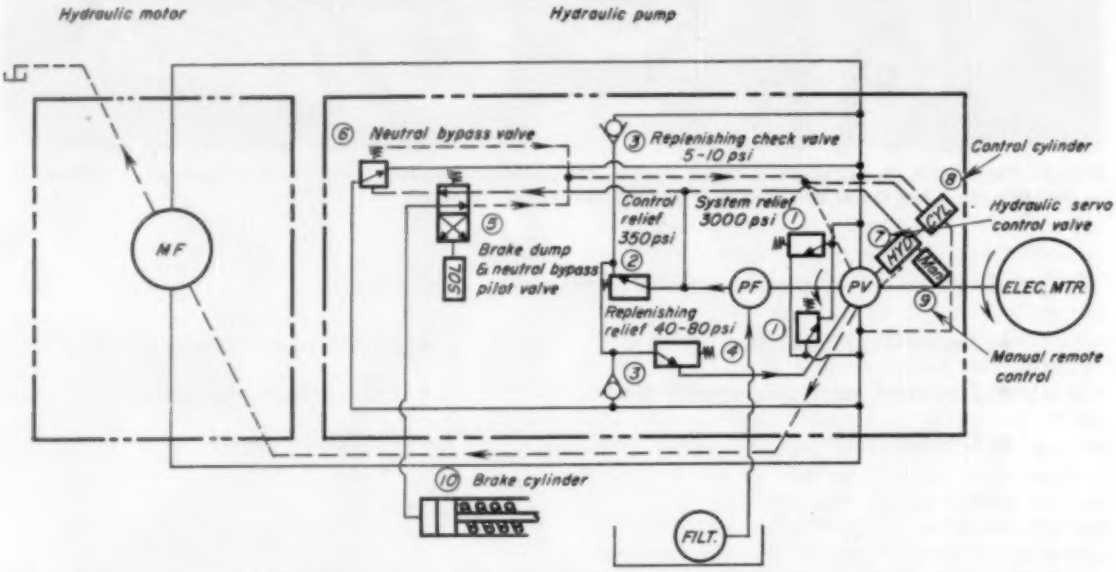
Another benefit from hydraulic drives is found to be an increase in the useful operating time of the equipment in port because of fewer breakdowns and less maintenance, advantages which result from the instantaneous overload protection afforded by the hydraulic drive. The ability of these drives to stall without damage, while continuing to maintain a predetermined maximum torque, also increases the safety as well as the speed of cargo handling.

Under many circumstances, the hydraulic winch drives can reduce peak power consumption—a very important factor aboard ship where power generating capacity is limited. This improvement results from the relatively high efficiency and the ability of these drives to exert extremely high torque at very low output speeds and low input power.

In addition, with the trend towards replacing di-

Continued on page 101

Operation of Winch Transmission



All the valving shown in the circuit drawing is mounted integral with the pump. The electric motor drives the variable displacement pump and a fixed displacement pump which is mounted internally with the variable pump. At all times, this fixed displacement pump supplies oil for control purposes, for replenishing of the variable pump and for circulation.

When the variable displacement pump is in neutral, no delivery position, the solenoid in valve 5 is deenergized putting the valve in the position shown. Pilot pressure is acting on bypass valve, 6, holding it open. This bypass valve prevents any oil which might be delivered by the pump from circulating to the fluid motor and causing creep. Any pumped oil, at this time, is shunted internally through the bypass valve from the pressure side to the suction side of the power pump. At the same time, the 4-way valve allows the spring loaded brake cylinder to dump to the pump case which sets the brake and prevents the load from shifting.

When the manual remote control, 9, is rotated to stroke the unit from neutral to either "hoist" or "lower", a neutral interlock switch energizes the solenoid of valve 5 shifting this valve which causes bypass valve 6 to close and applies pressure on the brake cylinder to cause brake release. This rotation of the remote control also rotates the inner rotor of the rotary servo valve, 7, to divert control pressure to either or both of the two servo cylinders to control the pump stroke and put the transmission into operation.

Should the operator attempt to operate the pump beyond the rated horsepower by trying to deliver a high volume at a heavy load, the cylinder control, 8, automatically repositions the rotary valve to prevent overload by reducing the pump stroke.

To change direction of the moving load, the transmission is stroked from one side of neutral to the other. As the control passes neutral, solenoid valve 5 is deenergized to cause brake operation before changing direction.

In case of power failure, valve 5 is automatically deenergized. The brake cylinder dumps and the brake is set by spring action to hold the load from falling.

Overload protection during either "hoist" or "lower" is provided by the pair of relief valves, 1, which act to shunt oil from pressure to suction without drop in pressure or load, whenever the pressure increases above 3000 psi. ▼▼▼

SPEED CONTROL METHODS FOR HYDRAULIC CIRCUITS

• By J. R. Fawcett

Speed control is an important consideration of many hydraulic systems. The following methods may be used to obtain variable speed control, constant speed control, or synchronization of rotating members.

VARIABLE DISPLACEMENT PUMP CIRCUIT

The simplest method of obtaining variable speed control is to connect a variable displacement pump directly to the actuator, see Figure 1. The speed of the actuator can then be controlled from zero to maximum in both directions. The only other factors which would normally affect the speed of the actuator would be slip and oil compression. These become greater as the pressure increases and cause the actuator to move slower. When this system is used to operate a hydraulic motor, the motor exhaust is taken back to the pump inlet. The pump thus resists any tendency for the actuator to overrun. If the pressure build-up becomes too great, oil is discharged through the relief valve. This system is used chiefly on variable-speed transmissions with a pump which can be controlled by a lever or hand wheel from full flow forward, through zero, to full flow in reverse. No valves are needed, and the operator regulates the speed and direction with only one control. For more general use the circuit would be designed so that the pump draws from the reservoir, and the exhaust is returned to it. Valves to control direction of flow would be as required. With this method the pump does not protect the actuator from overrunning, unless a check valve is incorporated in the actuator drain line to create a back pressure sufficiently large to resist any negative load.

LOCKED FEED CIRCUITS

Many years ago machine tool makers realized that for milling machines to operate satisfactorily with a constant speed hydraulic feed, the pump and table cylinder must be locked together to resist any

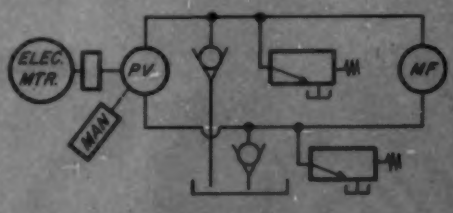


FIG. 1. VARIABLE DELIVERY PUMP CIRCUIT

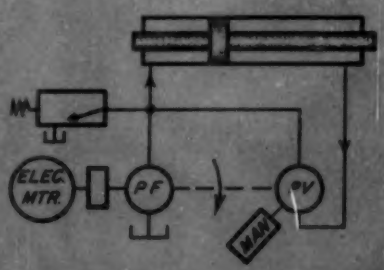


FIG. 2. BOOST PUMP CIRCUIT

tendency for the cutter to climb. One method of locking was the application of a boost pump which maintained the pressure at a few hundred psi to ensure that any air in the oil could not cause sponginess, see Figure 2. Although a big step forward, this did not give the complete answer to the problems raised by heavy milling operations, because it could not give a uniform feed when the cutter pulled the work forward as in climb milling. The Cincinnati Milling Machine Co. introduced the system shown in Figure 3 incorporating a differential relief valve. By varying the forward pressures to suit the work resistance, the valve ensures that the effective force on the piston remains constant. This produces a very uniform feed.

The relief valve has a two-diameter plunger and is designed so that back and forward pressures are combined in a fixed ratio to act against a spring. The primary function of this valve is as a relief valve for the output of the boost pump. Except for a small amount lost in leakage, the boost pump output passes through the valve to drain. Applying the back pressure to the annulus of the relief valve causes the valve to operate at a lower forward pressure that it would otherwise. If the work resistance is high, the back pressure is low, and the valve closes to produce a high forward pressure. If the work resistance decreases, the back pressure increases, and the valve opens to reduce the forward pressure. It is possible for the back pressure to build up to the system pressure before the valve ceases to function. The force moving the table cylinder remains constant whether work resistance is positive or negative.

USE OF A BACK PRESSURE VALVE

Another method of locking a variable delivery pump to a cylinder or motor is by connecting a back-pressure valve (counterbalance valve) in the cylinder or motor drain line. The valve opens at a preset pressure on the exhaust of the actuator. A check valve bypassing the back pressure valve is usually incorporated to maintain free flow on the return stroke of a cylinder. Although this method steadies the speed and prevents jumping when the tool breaks through, it cannot provide a steady feed when the tool resistance varies. It would, however, be quite satisfactory on a planing, shaping or drilling machine where the tool resistance does not vary greatly.

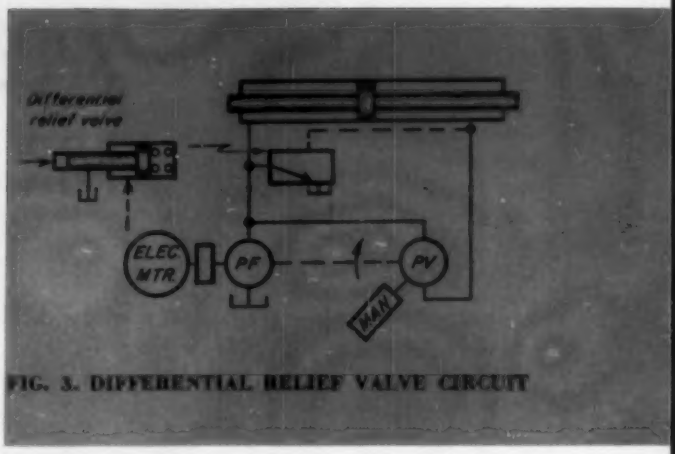


FIG. 3. DIFFERENTIAL RELIEF VALVE CIRCUIT

CONSTANT FLOW CONTROL VALVES

Many speed control problems can be solved with a fixed delivery pump and flow control valves. The simplest method is to control the oil flow to the actuator with a variable orifice valve and discharge excess oil through a relief valve set at the maximum working pressure. The flow through an orifice depends on the pressure drop across it and the viscosity of the fluid. If a constant flow is required, it is necessary to keep the pressure drop constant by using a pressure reducing valve in conjunction with the orifice, see Figure 4. As long as the pump capacity is sufficient, the valve inlet pressure and outlet pressure always differ by the spring pressure.

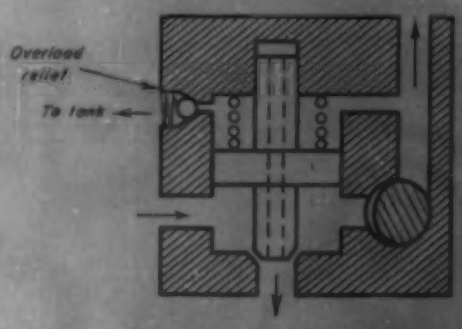


FIG. 6. COMPENSATED FLOW CONTROL WITH BUILT-IN RELIEF

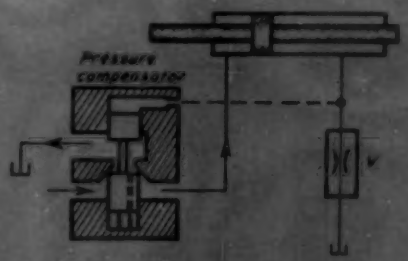


FIG. 7. SEPARATE PRESSURE CONTROL VALVES AND SPEED CONTROL VALVES

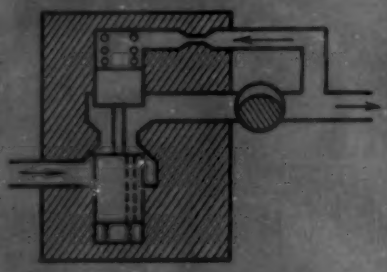


FIG. 4. PRESSURE REDUCING VALVE AND VARIABLE ORIFICE

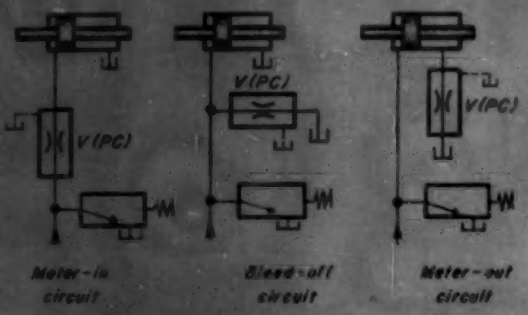


FIG. 5. APPLICATIONS OF VARIABLE ORIFICES

Simple variable orifices, whether pressure compensated or not, can be used in three ways as shown in Figure 5. A relief valve must be used in each case. For the meter-in and meter-out circuits, the pump pressure will always be equal to the relief valve setting. The meter-in circuit is the simplest, but does not prevent the cylinder from overrunning if the load is suddenly reduced or becomes negative. By connecting a back-pressure valve to the cylinder exhaust, the control is improved. In the meter-out method the piston is trapped between the two pressurized columns of oil. Very satisfactory control is obtained under most machine tool applications, although not so good as with a boost pump and differential relief valve. In the bleed-off method all oil except that required to actuate the piston is drawn off through the valve and passed to drain. Bleed-off control is not suitable for accurate speed regulation, but uses less power than the meter-in or meter-out methods, because the pressure is not normally built up to the relief valve setting during operation. The machine is stopped by opening a separate valve to drain, reducing the pressure to zero.

Although widely used, all these systems cause unnecessary waste of power and heating of the oil. When this is objectionable, especially on larger installations, consideration should be given to using valves which do not require the pump to operate at the full relief valve pressure during the working period. In some systems now available, the relief valve setting is automatically adjusted to blow off at the pressure due to the actuator resistance. The pump never has to deliver at a higher pressure than actually required to meet the load, and a saving in power and reduction in oil temperature is made.

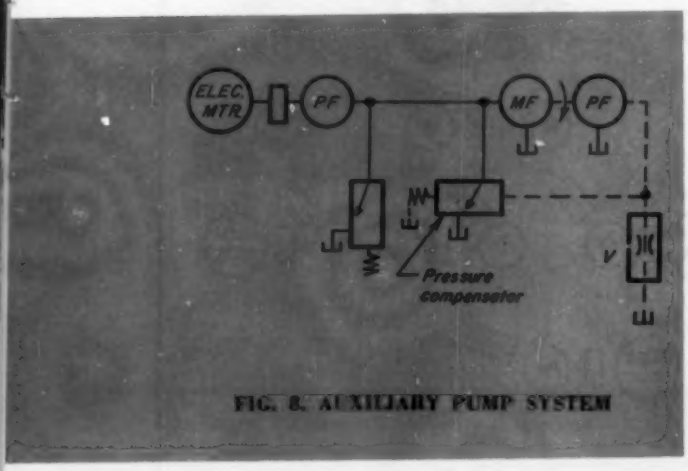


FIG. 6. AUXILIARY PUMP SYSTEM

CONSTANT FLOW VALVE WITH BUILT IN RELIEF

The combination flow control and relief valve shown in Figure 6 has a balanced piston actuated by the pressure on either side of the adjustable orifice. With no resistance from the actuator, the valve opens as soon as the pump pressure overcomes the spring pressure. Any back pressure due to the actuator meeting resistance adds to the spring pressure and increases the blow-off pressure. At maximum desired system pressure the overload relief opens to cause complete raising of the now unbalanced piston. The valve maintains a constant pressure drop across the orifice. This valve can only be used in a meter-in circuit.

PRESSURE CONTROL VALVE—SPEED CONTROL VALVE SYSTEM

Another system shown in Figure 7 has the pressure control valve and speed control valve as separate units. The speed control valve is connected in the discharge line and is connected to the pressure control valve by a pilot line. The pressure control valve is regulated by the pressure between the actuator and variable orifice. This pressure is kept constant by altering the pump pressure to balance any change in load.

CONTROL OF ROTARY FLUID MOTORS

It is sometimes necessary to run a motor at a very constant speed which can be regulated at will.

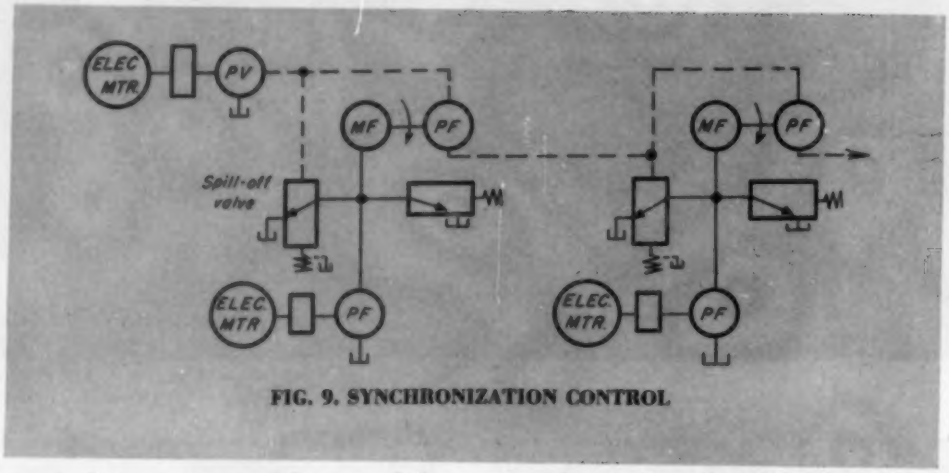


FIG. 9. SYNCHRONIZATION CONTROL

Exact control of the motor speed by any of the methods already described is not possible because varying loads and changes in oil viscosity alter slip in pump and motor, and the hydraulic compression of the oil in the lines. Even if it were possible to obtain a perfect direct-coupled hydraulic system, it would still not be possible to eliminate variations in the speed of the electric motor due to changes of load and frequency.

One solution to this problem is a system devised by Keelavite Rotary Pumps & Motors, Ltd. using an auxiliary circuit which has a small pump driven from the main hydraulic motor and discharging through a pressure-compensated variable-orifice valve, Figure 8. This control circuit which is not subjected to load is unaffected by variable slip or oil compression. Since it is not electrically driven, it is not affected by electric motor speed variations.

Any change of speed of the hydraulic motor causes a corresponding change in the pump output varying the pressure between the pump and variable-orifice valve. This pressure is connected to a bleed-off valve which maintains the hydraulic motor speed constant by bleeding off surplus oil. Tests on this circuit have shown that it is not possible to detect any speed changes with an ordinary tachometer, and a speed range of 5 to 1 is possible. Greater accuracy can be obtained by connecting a thermostatically controlled cooler on the pump circuit to maintain the oil viscosity constant.

SYNCHRONIZATION CONTROL

In practice, synchronization between several sets of hydraulic motor driven rollers is often needed

Continued on page 100

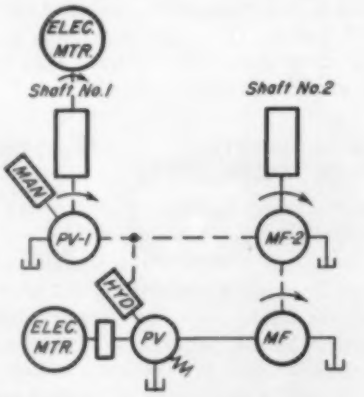


FIG. 10. PUMP-MOTOR CONTROL

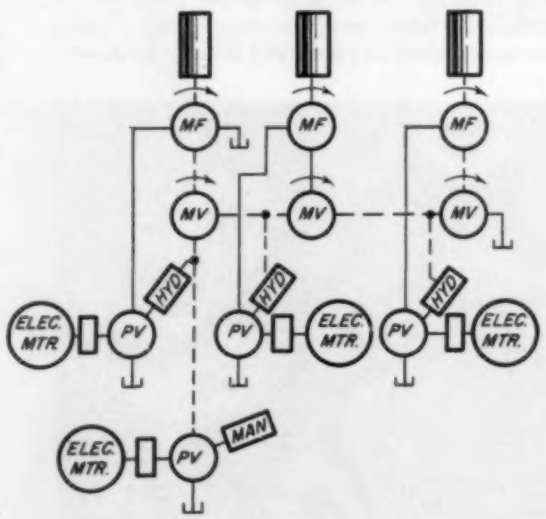


FIG. 11. MULTIPLE SHAFT CONTROL

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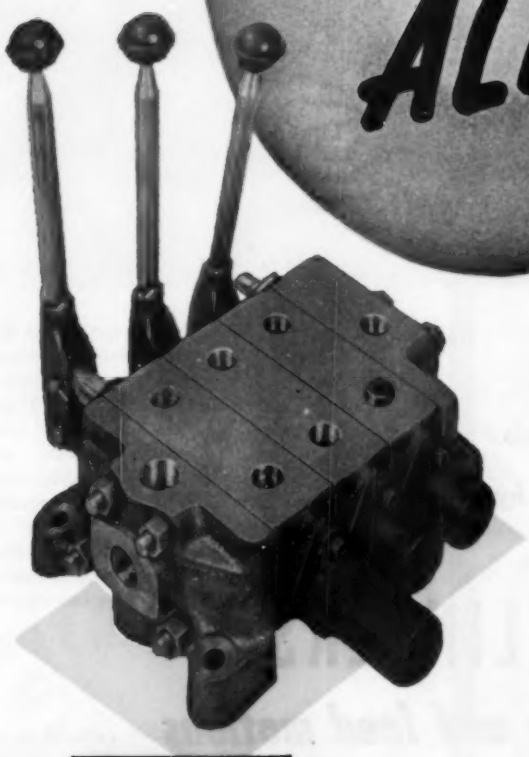

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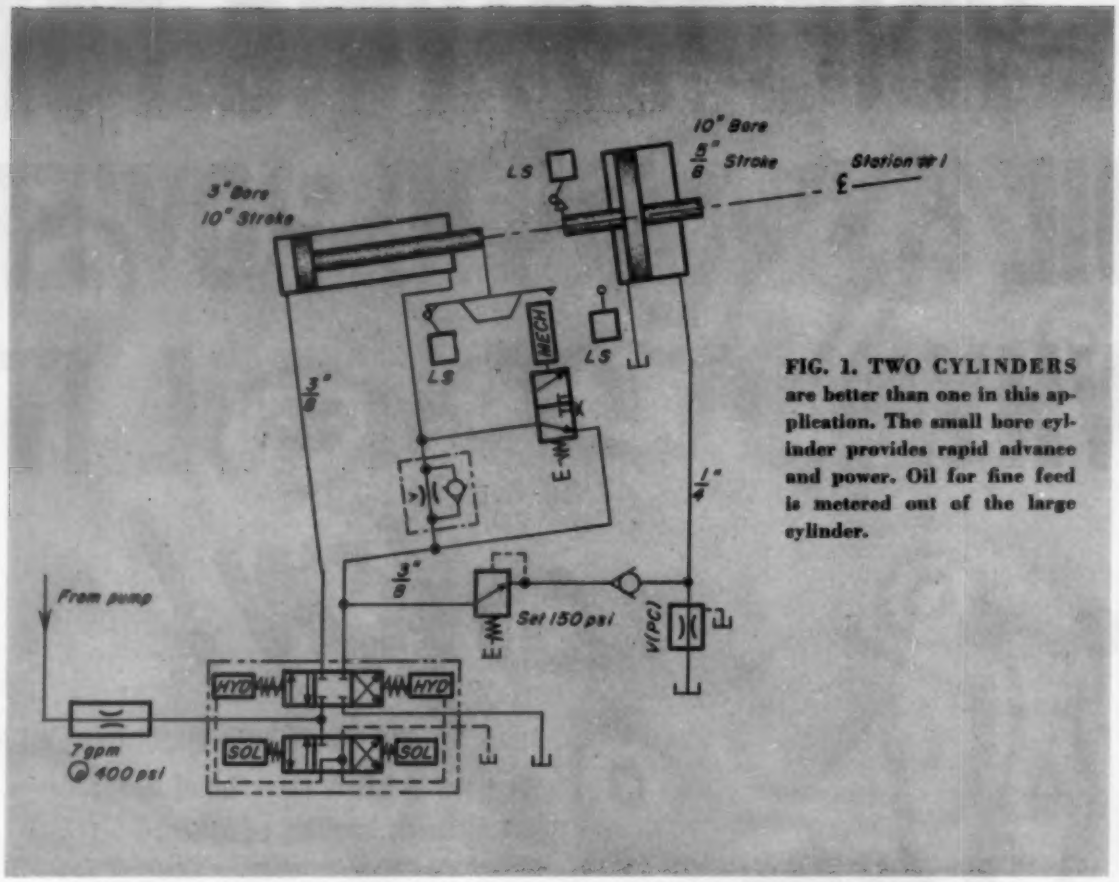


FIG. 1. TWO CYLINDERS are better than one in this application. The small bore cylinder provides rapid advance and power. Oil for fine feed is metered out of the large cylinder.

Metering oil to provide very slow cutting feeds often presents a problem which can be solved by using . . .

TANDEM CYLINDERS

. . . for rapid advance and feed motions

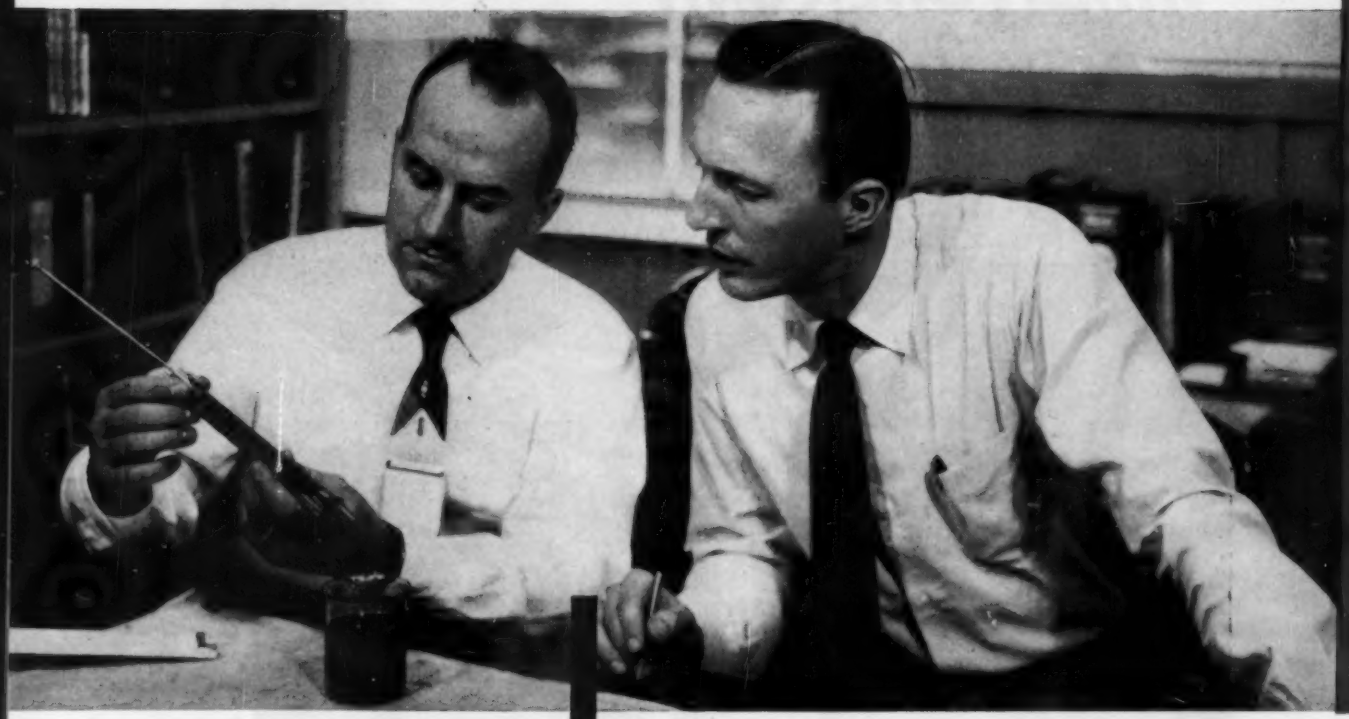
• By H. Cutler

ON MOST machine tools where an operation such as boring is powered hydraulically, there are generally three motions and speeds required—a rapid approach, cutting speed, and then rapid return. While there are many different types of hydraulic circuits which can be used to provide this control, in all circuits the speed depends on cylinder size and rate of oil flow out of the cylinder.

At times, the requirements for rapid advance and feed seem to oppose each other. For a given oil delivery, a small bore cylinder will of course move faster than a larger cylinder. Therefore, to obtain the desired rapid approach with a given pump, the cylinder size often works out to a small diameter. This is desirable for both cost and space. However,

H. CUTLER, *Control Engineer, Snyder Tool & Engineering Company, Detroit, Mich.*

Seven years service for STANOIL Industrial Oil at David Bradley Mfg. Works —No down time for lubrication



L. R. Cummings (left), Standard lubrication specialist, inspects sample of STANOIL, with Robert C. Menken, Plant Engineer of David Bradley Manufacturing Works. Larry Cummings has been serving industrial customers for Standard Oil since graduation from Standard's Sales Engineering School. His mechanical engineering degree from Tri-State College of Indiana qualified him for this work. Customers of Larry's find this experience and background pay off for them.

David Bradley Tri-Trac, handy piece of farm equipment gives farmer new opportunity for mechanization at low cost. Upper frame on which gasoline tank is mounted, is part formed in HPM press.

Seven years ago David Bradley Mfg. Works installed 900 gallons of STANOIL Industrial Oil in an HPM press. There's been no down time required for lubrication maintenance since. A pump by-pass screen filter is the only filtering the oil receives, yet the system continues clean. In March, 1954, an analysis of the oil showed:

Viscosity @ 100° F.	— 980
Color, NPA	— 6
Neutralization No.	— .11

STANOIL Industrial Oil has long been at work for Bradley. Successful operations with it in other equipment caused Bradley engineers to specify STANOIL for this installation.

The HPM double acting, fast traverse hydraulic press reported on here is used to draw the upper frames for the David Bradley Tri-Trac, compact farm tractor. The Tri-Trac is the newest implement in the Bradley line. Bradley has been making farm implements since 1832.

Like to know more about STANOIL? Perhaps it can serve you as efficiently as it is serving David Bradley. Lubrication specialists in any Standard Oil office will be happy to help. In the midwest, a call to one of them will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

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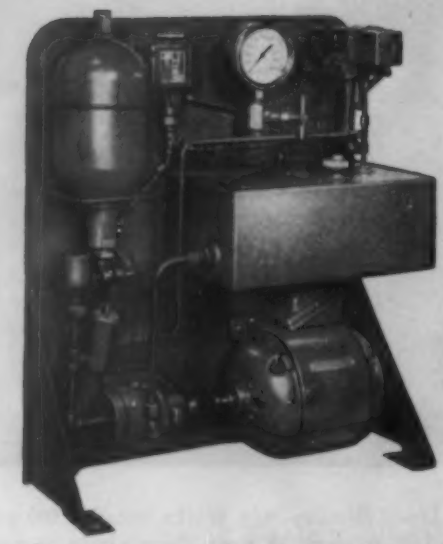
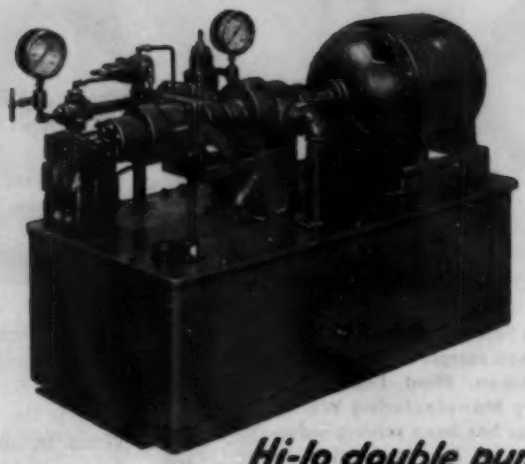


Panel mounted package?



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when this cylinder piston must go into slow feed, the amount of oil now discharging from the small bore may be inadequate for safe, accurate metering through available flow control valves. It is not generally recommended to meter oil at a rate of less than 5 cubic inches per minute through a flow control valve. Even this minimum rate often proves troublesome because of the very small orifice size which must be used. To reduce any possibility of faulty operation of the metering valve it is well to be able to design the circuit so that the required feed rate can be obtained while 50 to 100 cubic inches per minute is controlled by the metering valve.

What is the designer to do when confronted by the dilemma of having a cylinder which is fine for rapid approach but no good for feeding? One solution is to increase the cylinder size and pump delivery. This is expensive and may be impossible because of space.

On a three station boring and facing machine built by Snyder Tool & Engineering Company, this speed problem was solved by using tandem cylinders. The control circuit of the boring head at station 1 is shown in Figure 1. Circuits for the other stations on the machine are similar. Operating at 100 percent efficiency, one part is completed in about 45 minutes. From load to unload, the cycle is automatically controlled by limit switches and timing relays.

Boring feed stroke is quite short, only $\frac{5}{8}$ inch. Rapid advance is about $9\frac{3}{8}$ inches and return is 10 inches. Power, 2900 pounds of force, for boring is developed by 400 psi acting on the blank end of a 3 inch cylinder. With only seven gpm delivered to this part of the machine circuit, rapid approach is completed in $2\frac{1}{2}$ seconds. However, out of the rod end of this 3 inch cylinder there is only about $5\frac{1}{2}$ cubic inches of oil for every inch of travel. With a boring distance of $\frac{5}{8}$ inch, the volume of oil available for metering would be dangerously small if boring time is 40 seconds or more. Use of the large 10 inch bore tandem cylinder during the feed part of the stroke makes available enough oil to safely control the feed.

CAM VALVE CONTROL

Here's how this circuit works. Shortly before the end of the rapid approach, the cam trips the mechanically operated valve closed so that oil out of the 3 inch cylinder must flow through an adjustable needle valve. This valve is set to decelerate the cylinder and cushion its contact with the boring feed cylinder. Power is supplied by oil pressure against the blank end of the small cylinder, and feed control is provided by an adjustable pressure compensated flow control valve metering oil out of the 10 inch cylinder. On this machine, about 65 cubic inches per minute flows through the metering valve during normal boring feed.

On the return stroke, oil is supplied through the 150 psi pressure reducing valve to return the large cylinder and refill it for the next stroke.

This tandem cylinder arrangement is an economical solution to providing optimum approach and feed rates. ▼▼▼

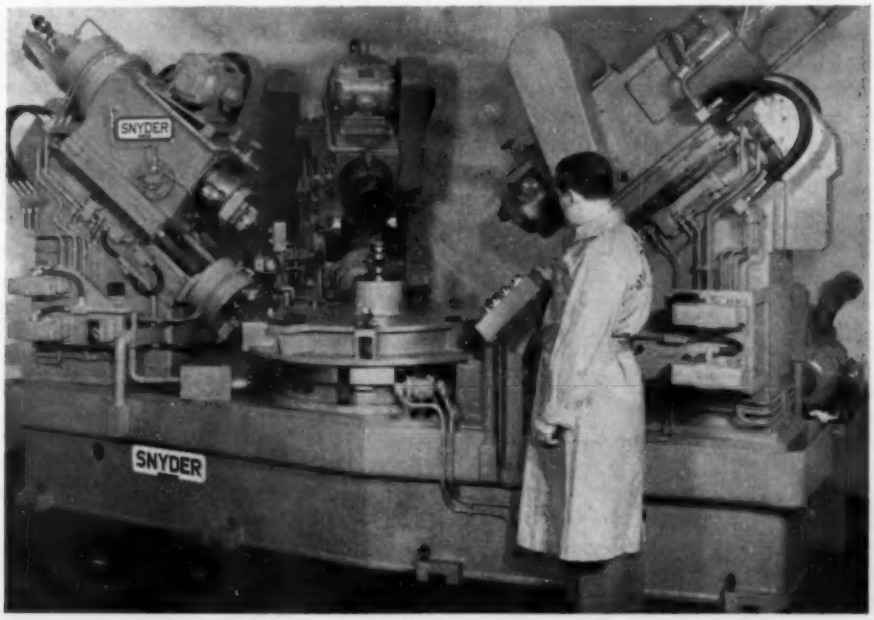

FIG. 2. THREE BORING and facing stations use tandem cylinders for feed control. The 45 minute cycle is automatic from load to unload.

What's Being Done To

REDUCE VALVE SOLENOID FAILURE?

Hours of machine down time are being cut by reducing the number of solenoid failures on fluid powered equipment.

Two programs are increasing solenoid life: 1) Better valve design 2) Effective preventive maintenance

SOLENOID failure has been one of the major sources of maintenance costs and machine breakdown on hydraulic and pneumatic equipment. With solenoid operated valves being used in greater quantities on automatic machinery, extensive programs are underway to eliminate solenoid failure as a cause of machine down time.

Investigation has shown that the largest single cause of solenoid failure is contamination of the solenoid operating members. This contamination which is usually in the form of oily cast iron, steel chips and dust causes solenoids to stick open and burn out.

How do solenoids get contaminated? There are two good causes. First, maintenance and operating men often remove solenoid enclosures to manually operate the valves and then neglect to replace them. Second, the solenoid enclosure is sometimes poorly designed and does not prevent contamination from coming in contact with the solenoid members.

Preventing enclosure removal is quite difficult. Once removed, the covers often wind up as grease cups or ash trays. Putting a chain on the cover so that it can't easily be separated from the solenoid is helpful. Also providing a suitable means to manually operate the valve without removing the enclosure helps to eliminate the reason for cover removal and loss. For a positive solution to the "Case of the Lost Covers", at least one machine tool builder and several valve manufacturers mount the solenoid on the cover. Without the cover the valve won't operate.

Valve manufacturers are solving the enclosure design problem to prevent the entrance of dirt. Sufficient sealing of the enclosure is being provided to permit valve operation even when placed in contaminated water. The enclosures are made large enough to hold the taped pigtail leads. This eliminates the need for a separate junction box. Valve manufacturers are now incorporating solderless pressure connectors on pigtail leads, threaded electrical conduit connections, and captive cover screws to prevent loss of screws.

All these design features will help considerably. But, a 100% elimination of solenoid failure requires a good preventive maintenance program in your plant.

▼▼▼

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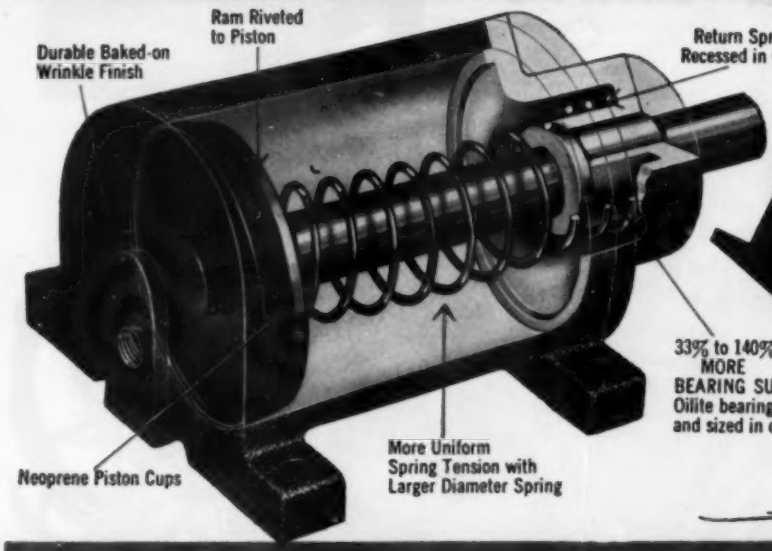
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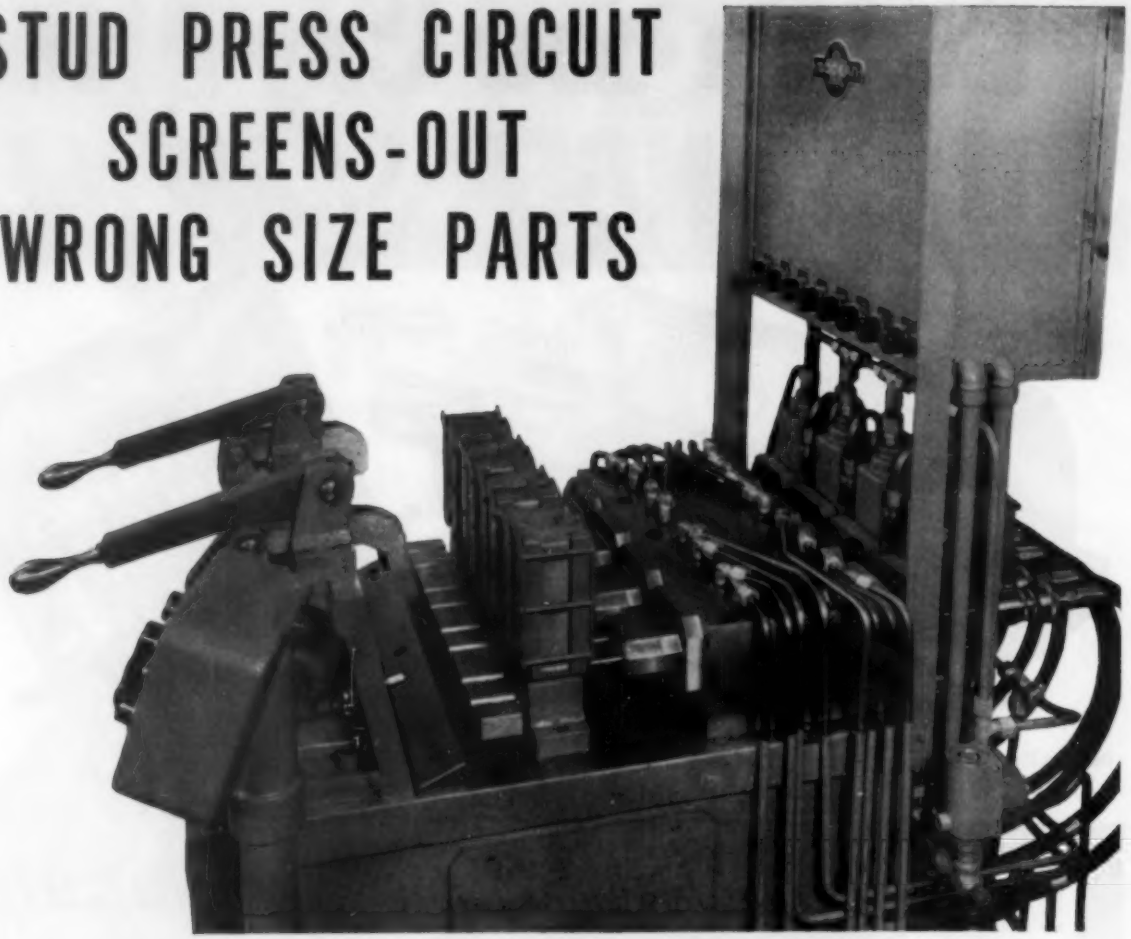
Pathfinder in AIR POWER AUTOMATION

STUD PRESS CIRCUIT SCREENS-OUT WRONG SIZE PARTS



EIGHT PRESSING assemblies are mounted on one machine. Studs are pushed out of the holding magazine into the cylinder head block which will be clamped in the machine by action of the hand levers.

WORKING with the engineers of McKinnon Industries Ltd., Modern Tool Works Ltd. of Toronto designed a special machine to press rocker arm studs into the cylinder head of an automobile engine. With their design, only studs of sufficient interference are pressed home. "Screening-out" or rejection of studs with insufficient or excessive interference is accomplished by an ingenious hydraulically powered circuit tied in with signal lights.

The entire "sensing action" is built into the press head shown in the drawing. Oil from a 2500 psi pump powers the press action. As seen in the drawing, the press cylinder is very different from a conventional double ended cylinder. The piston head is a sliding member on the piston rod. There is also a compression spring which limits pistons head travel and plays an important part in the "screening-out" of wrong size parts. Two cams mounted on one end of the piston rod are located to trip a limit switch and shut-off valve which are a part of the sensing and signal system.

Here's what happens when parts have proper interference, or are too loose or too tight.

PROPER INTERFERENCE

On pressing the cycle start button, 2500 psi oil pressure is admitted to the head end of the cylinder. This displaces the oil from rod end, through cam valve "A". The piston rod assembly moves forward, picking up the stud from the magazine and entering it in the cylinder head. As interference pressure builds up between the stud and the cylinder head, die spring "B" (1100 lbs fully compressed) is compressed solid by piston "C". This aligns the port in

Here's a tooling idea which has many possible applications. Press-fitting two parts together isn't much of a problem if the parts are properly sized. But what happens when there is too much or too little interference between parts? Does your pressing tool pick out the bad pieces and reject them or at least warn the operator that the parts are no good? With a little ingenuity, oil powered pressing tools can be made very selective to assemble only those parts which have the proper interference.

the piston with port "D" in the piston rod. Cam "E" now pinches off valve "A" and the rod end of cylinder is vented to tank through port "D" and the piston rod. This permits a forward movement of the piston rod assembly, until washer "F" bottoms on end cap "G", which finally positions stud to correct depth. Cam "H" then trips limit switch "I" and the panel indicator lights signal the operator that the stud is home. When all lights are on, the machine automatically resets ready for the next cycle.

INSUFFICIENT INTERFERENCE

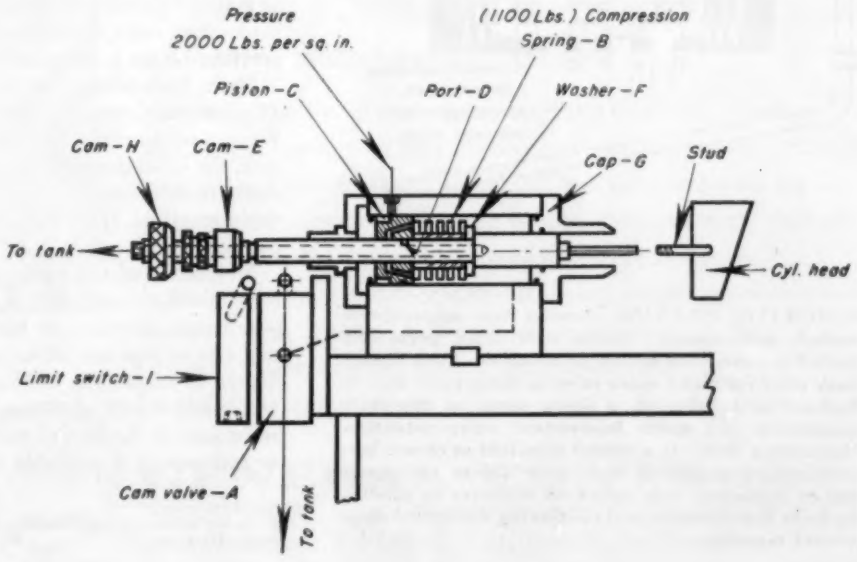
The same preliminary procedure applies in this phase—2000 psi oil is admitted to the head of the cylinder, causing the piston and rod assembly to move forward engaging the stud and entering it in the cylinder head.

Now, because of insufficient interference the die spring "B" is not compressed and as a result, the piston and port "D" are not in line. Further movement causes cam "E" to pinch off valve "A", causing the oil in rod end to be trapped and preventing stud from being driven home. Limit switch "I" is not tripped when this condition prevails and the indicator lights failing to signal tell the operator that the fit of the stud is defective. He then removes the stud, marks it as defective and manually resets the machine ready for its next cycle.

EXCESSIVE INTERFERENCE

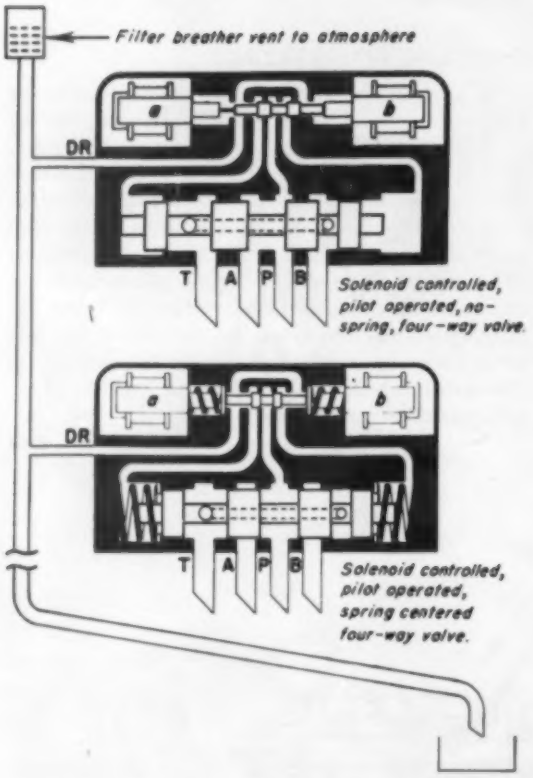
Pressing the start button admits 2500 psi oil to the head end of the cylinder, entering the stud into the component and compressing die spring "B" solid, venting rod end through piston rod. Now, because of excessive interference, the 2000 psi applied to the head of the piston is inadequate to drive the stud home. Again, limit switch "I" fails to make contact and the panel lights do not signal, indicating to the operator that the stud has failed to go home. By gauging the depth to which the stud was driven into the cylinder head, it is possible for the operator to distinguish whether the stud failed because of insufficient or excessive interference.

▼▼▼



POWER for pressing and control for rejection of rocker arm studs are built into this assembly.

VENTED DRAIN MANIFOLD PREVENTS FAULTY VALVE ACTION


Filter breather vent to atmosphere
DR
T A P B
Solenoid controlled, pilot operated, no-spring, four-way valve.
DR
T A P B
Solenoid controlled, pilot operated, spring centered four-way valve.

SCHEMATIC DRAWING showing two solenoid-controlled, pilot-operated valves with drain ports connected to a common header or manifold. Even though both pilot valve and main valve in these units may be hydraulically balanced, a sharp surge at the drain connection can cause inadvertent valve actuation. Connecting drains to a vented manifold as shown here prevents surges which may cause valves to operate out of sequence. Note manifold diameter in relation to drain line diameter and continuing downward slope toward reservoir.

• By E. H. Gatwood

IN AN oil-hydraulic circuit involving many valves which must function in a definite sequence, avoidance of the possibility of inadvertent valve shifting is an important design consideration.

The most reliable means of preventing valve shifting is to return all drain lines separately to the oil reservoir. This is rarely practical in view of space limitations where a large number of valve units are involved. The convenient alternate is to connect all drains to a common header or manifold which, in turn, is piped to reservoir. If the header or manifold is allowed to remain full of oil, however, inadvertent valve actuation may occur as a result of pressure surges in this manifold.

Drain lines return two types of flow to reservoir: (1) internal seepage and (2) used pilot flow. When a pilot-operated valve is shifted by pilot pressure, the oil at the opposite end of the valve spool is discharged through the pilot valve and into the drain manifold. If the drain manifold is full of oil, a pressure surge results.

Magnitude of the surge depends on several factors. Speed of valve shift, amount of oil discharged, pipe length, number of bends, restrictions if any, and size of pipe are all factors which can affect the degree of surge. The discharged oil must go somewhere and it will, of course, follow the path of least resistance. If the path to reservoir is sufficiently long or tortuous, it is probable that the surge will bring

Continued on page 76

E. H. GATWOOD, *Circuit Engineer, Vickers Incorporated, Detroit, Michigan*

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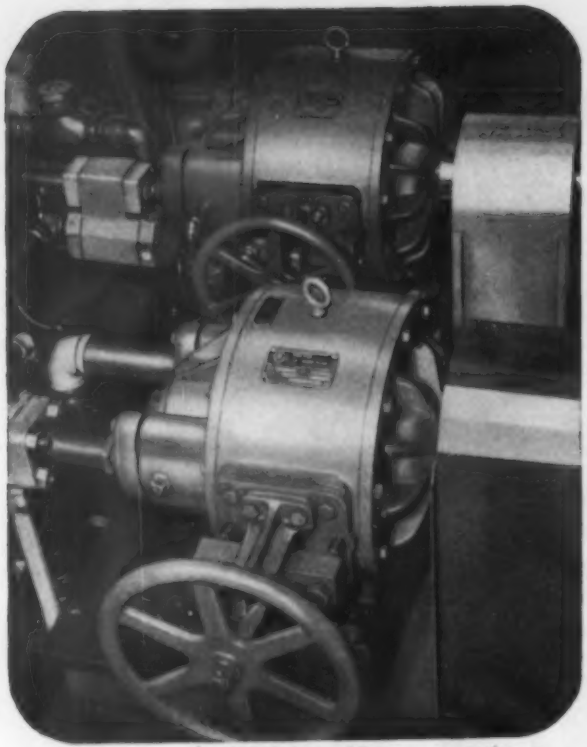

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Vented Drain Manifold

Continued from page 74

about out-of-sequence shifting of other valves.

The drawing at the left shows two solenoid-controlled, pilot-operated valves. The pilot valves are balanced (their end areas are equal) and, in the spring-centered version, the main spool is also hydraulically balanced. Hydraulically balanced valves are usually considered to be free from the danger of inadvertent shifting. Theoretically, then, both pilot valve and main spool should be unaffected by a drain line surge. In practice, however, the drain or pilot passages within the valve body may not be entirely filled with oil, permitting the surge to become effective on one end of the spool in advance of the other. Such a condition can cause the valve to inadvertently shift. There are also other "freak" conditions, beyond the control of the designer, which may occur to cause out-of-sequence shift. For this reason, it is advisable to take every precaution to minimize the possibility of drain line surge. Where pilot valves which are not hydraulically balanced are employed, use of a vented drain manifold is of still greater importance because these valves are especially susceptible to inadvertent shifting caused by drain line surge.

If a pilot valve is caused to inadvertently shift, pilot pressure from this valve shifts the main spool of the pilot-operated valve, resulting in movement of an actuating mechanism. Drain line surges, therefore, can have a significant effect on safety and reliability in a given oil-hydraulic circuit.

HOW TO PREVENT DRAIN LINE SURGES

One popular method of minimizing the possibility of drain line surge involves gradual increase of manifold size as it progresses toward the reservoir. This practice is not entirely safe, however, if the manifold is allowed to remain full of oil. The path of least resistance may still be toward the drain connection of another valve rather than to reservoir.

The best solution to the drain line surge problem, aside from returning all drain lines separately to the oil reservoir, is the use of a vented drain manifold. A line from the manifold extends above the uppermost unit and is capped by a filter-breather. This opens the manifold to atmosphere and permits drainage oil to be returned to the reservoir by gravity.

The manifold should be large in relation to individual drains connected to it. It should have a continuing downward slope toward the reservoir. With no level portions in its length, the manifold is virtually empty at all times and cannot be subjected to a pressure surge. Discharged oil spits into the manifold and is carried off harmlessly to reservoir. Drains from the individual units may be connected to the manifold wherever convenient.

Use of a vented drain manifold conforms to recommendations of the Joint Industry Conference (J. I. C.) ▼▼▼

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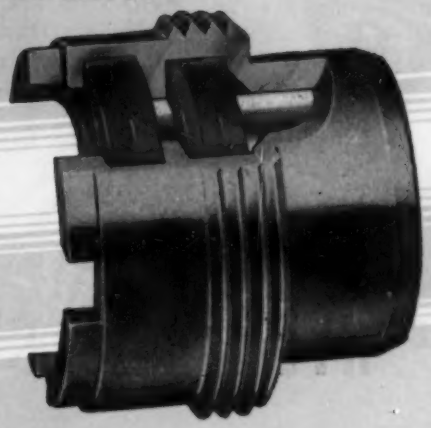

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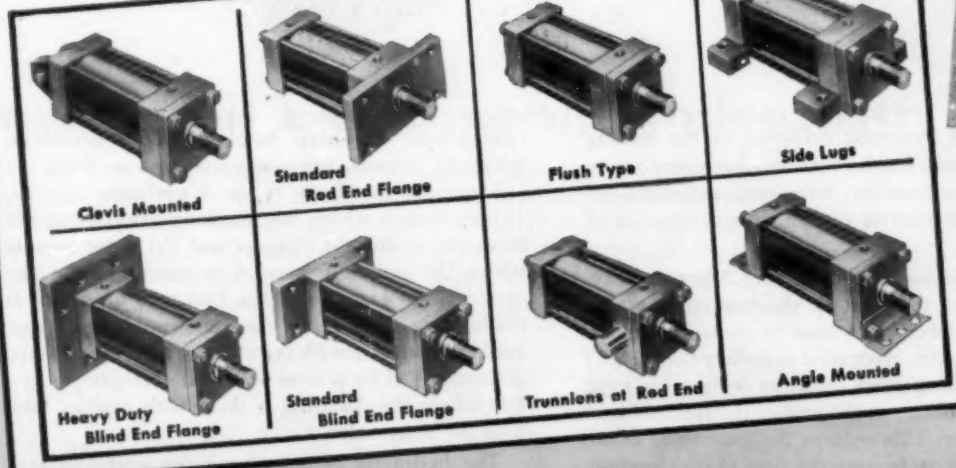

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HYDRAULIC CYLINDERS AS SNUBBERS

• By Everett G. Gravenhorst

Built-in deceleration devices in hydraulic cylinders reduce impact loads. Here's the design story of devices which give snubbing over the entire length of stroke or only during the end of the stroke.

Availability of hydraulic cylinders in the moving of heavy loads has been known for many years. With slight modifications, these same cylinders can also be used to restrict or snub the movement of large masses.

Most modern high-speed aircraft depend on hydraulic cylinders to soften the shock of landing and, with built-in orifices, are used to control deceleration at touch-down. Hydraulic cylinders that retract and extend landing gears are often designed to snub or absorb the energy at the end of the retraction or extension stroke. This reduces the magnitude of the impact loads by increasing the time of deceleration.

Cylinders are also used as snubbers in such applications as shimmy dampers for nose wheels, arresting-hook snubbers, bomb-bay door actuators, wing-fold circuits, ramp actuators and so forth.

There are two basic types of snubbing circuits, (a) the system where the snubbing components are contained within the cylinder and (b) those circuits where the snubbing control is external from the cylinder. An example of the first type of circuit is the landing shock strut where the snubbing components are integral with the cylinder; the second type is exemplified by a nose-wheel shimmy-damper system where the damping is done with orifices built into the steer valve.

The hydraulic cylinder used for snubbing may be a part of the airplane hydraulic system. It may also be used as a means of actuating some component or, it can be a completely isolated unit containing its own oil supply and provisions for thermal expansion.

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EVERETT G. GRAVENHORST, *Chief Mechanical Engineer, The Glenn L. Martin Company, Baltimore, Md.*

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ders connected directly to the airplane hydraulic system is usually through thermal relief valves built into the control valve, controlling the flow of fluid to the cylinder or through leakage built into the control valve.

When the snubbing components are integral with the cylinder, they can be designed to give snubbing over the entire length of the stroke or, as is often the case, to give snubbing during only the final portion of the stroke. Although more complicated, the use of snubbing over only a portion of the stroke is justified where the elapsed time of operation of the cylinder must be kept to a minimum while still controlling the maximum forces due to deceleration of the load.

The cylinder that retracts the landing gear is often designed to snub during the final portion of the stroke. Here, it is important that the landing gear be retracted as quickly as possible to "clean" up the ship and reduce drag during take-off. Due to the large shock loads that would be present if the heavy landing gear were suddenly brought up against stops, snubbing is necessary at the end of the stroke.

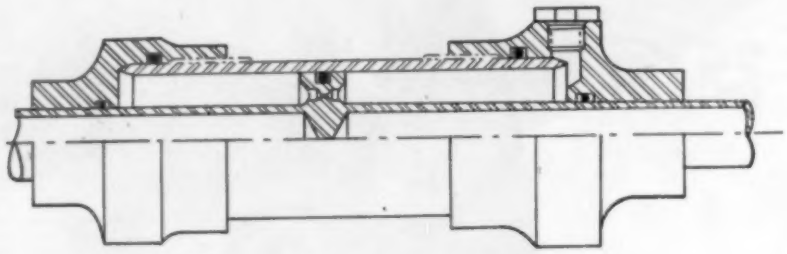

FIG. 1. SNUBBING CYLINDER has a drilled orifice which permits equal fluid flow to both sides of the cylinder.

The simplest snubbing cylinder design consists of a cylinder fitted with a piston. A drilled orifice permits equal fluid flow to both sides of the cylinder. Figure 1 shows this type of cylinder with the piston rod extending from both sides. This arrangement allows snubbing to occur during the entire stroke. If there is no orifice in the piston, some provision must be made to accommodate the fluid displaced by the piston rod during the retraction stroke.

The velocity of the piston and pressure in the above case can be determined from the following expressions:

$P = W/A$ Where P = Hydraulic pressure, psi
W = Weight of load, lb.
A = Area of piston, square inches.

and $V = K_1K_2\, a/A \sqrt{2P/\rho}$
Where V = Velocity of piston, inches per sec.
A = Area of piston, square inches
a = Area of orifice, square inches
P = Hydraulic pressure, psi
ρ = Density of fluid, lb/in^3
K_1 = Coefficient of Discharge
K_2 = Constant

The coefficient of discharge can be assumed constant for this discussion although the actual value is dependent to some extent on the geometry of the orifice, the fluid viscosity, the wall finish of the orifice, and so on. The value that ties in well with experimental results is 0.61, and as stated above, it will be assumed constant.

If the cylinder, shown in Figure 1, was a part of the airplane hydraulic system instead of being self contained, the design would have been such that the orifice was at the cylinder port returning oil to the reservoir. The moving piston would have then forced the fluid through the orifice, the size of the orifice again determining the speed at which the load or weight falls. If this same cylinder were used to raise the load, a large portion of the available pressure would be used in forcing the fluid through this same orifice into the cylinder, resulting in low efficiency. The pressure drop across the orifice can be avoided by bypassing the orifice with a check valve, so placed to allow free flow into the cylinder but checking the flow out of the cylinder. Another more compact arrangement is to drill a hole in the check-valve poppet and eliminate the fixed orifice, placing the check valve to again allow free flow into the cylinder but restricting the flow out of the cylinder; the orifice in the poppet restricting the flow.

Instead of having the orifice built into the cylinder or attached to it externally, the orifice can be placed at some distance from the cylinder. In some systems the orifice is placed in the return port of the control valve to limit the speed of operation in both directions. Careful thought should be given to any system having restriction remote from the cylinder if the snubbing is necessary to keep speed of operation and resulting loads within safe limits. The cylinder with the integral snubbing has the added safety feature that the fluid can be kept under control without the use of tubing and tube fittings.

In the cases discussed, the restriction occurs during the entire piston stroke. Often, it is not desirable to restrict the speed of operation for the entire stroke, but instead, provisions are made to restrict the speed during the final portion of the stroke. Here again, this snubbing can be either integral with the cylinder or achieved in the external hydraulic circuit.

In the externally controlled snubbing circuit, a

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sequence valve triggered by the piston at the proper portion of the stroke could be used to divert the flow of the fluid through the restrictor, thus slowing down the piston. This restriction could take several forms, each with its own special characteristics. The restrictor could be a flow regulator, keeping the speed of the piston constant regardless of load variations; it could be a relief valve which would keep the cylinder pressure constant; or it could be an orifice with the speed of the piston a function of the load.

The most common form of partial stroke snubbers are cylinders with integral snubbing so designed that it only becomes effective during the final portion of the stroke. This type of snubbing can be accomplished in several ways: (1) the movement of the piston can actuate some internal valving means, thus closing off the main fluid path and leaving only a restricted flow path for the fluid; (2) the area of the main fluid flow path can be reduced toward the end of the stroke by means of a metering needle attached either to the cylinder head or to the piston, and so arranged that it will enter the exit flow orifice and reduce the area available for fluid flow; and (3) many ingenious devices that make use of trapped oil displaced by an auxiliary piston to serve as snubbers.

Figures 2 through 5 show several commonly used integral partial-stroke snubbing schemes. Figure 2 shows a spring-loaded valve poppet permanently attached to the piston in such a manner as to prevent it coming loose from the piston while still allowing enough freedom to permit the valve to engage its seat for the duration of the snubbing stroke. The poppet has an orifice drilled in its nose in much the same manner as a poppet in a one-way restrictor is drilled. When the piston retracts to the point where the snubbing stroke begins, the valve poppet seats on the valve seat, which is also the fluid flow outlet, thus causing the oil to flow through the small orifice in the nose of the poppet. This results in a decrease in the rate of flow due to added restriction. When the cylinder is extending, the oil flow lifts the poppet off its seat, permitting the oil to pass into the cylinder virtually unrestricted.

Figure 3 represents a type of snubber very frequently used in landing gear shock struts. Here, a metering needle is used to control the flow-path area. The contour of the needle can be designed to give any type of stroke-orifice area relationship the designer desires. An example presented at the end of this article demonstrates how to design such a needle to give constant deceleration during the snubbing stroke.

Another type of integral snubbing is shown in Figure 4. In this design a slide valve is used to progressively shut off a series of orifices to effect snubbing by gradually increasing the resistance to flow. The size and location of each of the orifices can be selected to give accurate control of the snubbing characteristics. While this design requires the use of a lapped, or at least a closely-fitted slide valve, it has the decided advantage of not requiring close concentricity tolerances between the piston and the cylinder head, as is required in the type snubber shown in Figure 3.

Figure 5 shows the same method of variable restriction applied to a cylinder using trapped oil in the snubbing device for snubbing. Except where such design is dictated by space or other requirements, it is usually not practical because the volume of oil available for snubbing is often less than that

Partial Snubbing Devices

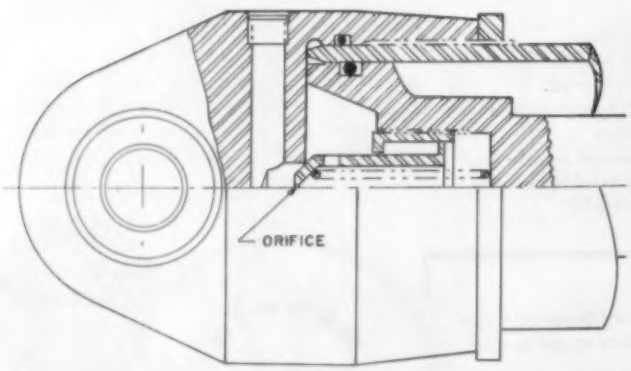


FIG. 2. SPRING LOADED valve poppet is built into the piston head. At the end of the retraction stroke, the poppet closes off the large oil port causing flow through the orifice. On extension, oil flow lifts the poppet off its seat.

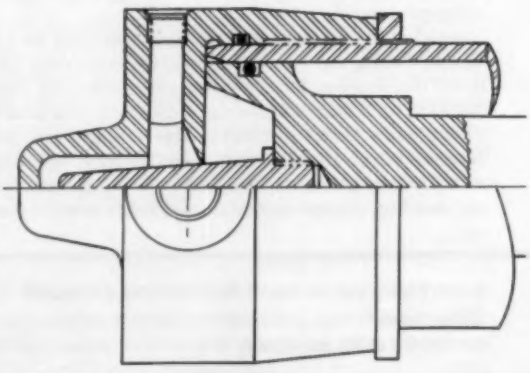


FIG. 3. A METERING NEEDLE controls the flow path area at the end of the stroke.

available in the cylinder, therefore, higher pressures, smaller orifices and closer tolerances must be used to attain the same results.

Although these last examples all show snubbing on the retraction stroke of the cylinder, it is often just as desirable to have snubbing on the extension stroke. Due to the added complexity resulting from the necessity of providing for a piston rod in the center of a cylinder; rod-end snubbing runs a very poor second to head-end snubbing. This point should be kept in mind when planning a snubbing cylinder installation.

Figures 6 and 7 show cylinders designed for rod-end snubbing. In Figure 6 the oil trapped back of the auxiliary piston is forced through the orifice, thus effecting snubbing. Figure 7 shows a cylinder with the piston rod contoured much the same as the metering needle described at the beginning of this article. In this case the piston rod acts as the metering needle, restricting the flow of oil through the annular orifice. The piston rod being designed by the magnitude of the cylinder load is much larger than a corresponding metering needle need be. For a given amount of restriction, the larger the metering needle diameter the smaller the allowable clearance to form the orifice. In addition, there is the added disadvantage of having less displaced oil to use for snubbing, resulting in further reduction in the allowable clearance. Keeping these points in mind, it can be understood why rod-end snubbing is less satisfactory.

CALCULATING ORIFICE SIZE

Two examples are taken to demonstrate the method used to calculate snubbing cylinder orifice size.

1. Calculate the area of the orifice required to limit the speed of fall of a 10,000-pound weight supported by a cylinder two feet per second. The allowable cylinder pressure is 3000 pounds per square inch. W/P (weight/press) = Cylinder Area = 10,000/3000 = 3.33 square inches. Q (flow) = 3.33 x 2 (feet per second) x 12 = 79.92 cubic inches per second.

Using the orifice flow equation $Q = KA_o \sqrt{\frac{2Pg}{\rho}}$

$$79.92 = 0.61\ A_o \sqrt{6000 \times \frac{32.2 \times 12}{0.032}}$$

$$= 0.61 A_o \sqrt{6000 \times 12075}$$

$$79.92 = 0.61\ A_o \times 77.5 \times 110 = 5200.25\ A_o$$

$$A_o = \frac{79.92}{5200.25} = 0.01536$$

Hence, an orifice having an area of 0.01536 square inches will restrict the flow from the above cylinder so as to allow the weight to fall at the rate of two feet per second.

2. This problem is to design a cylinder that allows a 1000-pound weight to fall free for the first 20 inches of the stroke and then snubs for the final five inches of stroke so as to reduce the impact loads when the falling weight hits the stops.

The total energy to be dissipated is

$E = 1000 \times (20 + 5) = 25{,}000$ inch-pounds

The velocity of the load when snubbing begins is

$V = 2gs$ Where $g = 32.2$ feet per second^2
s = free-fall distance, feet = 20/12
V = Velocity, feet per second

$V = 2 \times 32.2 \times 20/12 = 10.3$ feet per second

Knowing the velocity of the load at the start

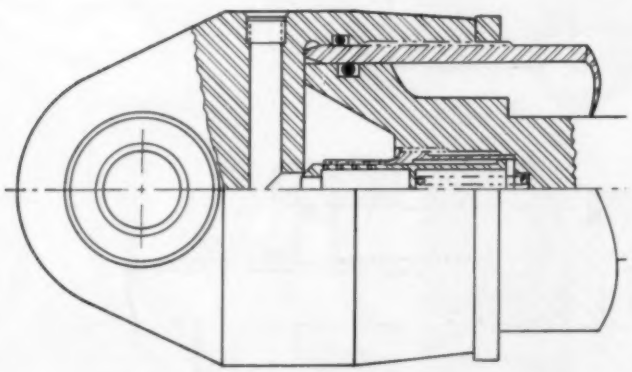


FIG. 4. A SLIDE VALVE progressively shuts off a series of orifices to effect snubbing by gradually increasing the resistance to flow of the oil.

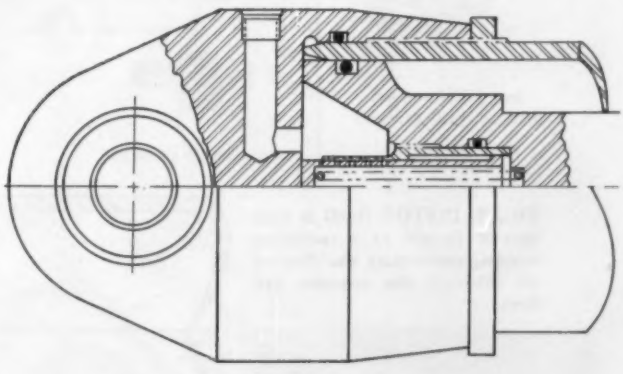


FIG. 5. TRAPPED OIL is used for snubbing as the slide valve in the cylinder closes off a series of orifices.

of the damping cycle and the length of the damping stroke, we can calculate the time of damping.

$S_d = Vt + 1/2\ (At^2) = 5/12$ feet

Where S_d = damping stroke feet
V = vel. of load, feet per second
t = damping time, seconds
A = acceleration, feet per second^2

and also:

$$\frac{V_1 - V\ final}{t} = -A$$

Solving these two equations simultaneously:

$t = 0.081$ seconds
$A = 127$ feet per second^2

The snubbing force due to this deceleration can be calculated from:

$F = MA$ or Force = Mass x Acceleration

$$= \frac{1000}{32.2} \times 127 = 3950 \text{ pounds}$$

To this amount must be added the weight of the load giving a total force of 4950 pounds.

Having found the snubbing force exerted by the piston, we can calculate the area of the piston required. Let us assume we want to keep our cylinder pressure around 1500 psi. then:

4950/1500 = 3.29 square inches or a diameter of 2.05 inches

The closest standard "O" ring seal is two inches so we will use a cylinder having a two-inch diameter. This means that our actual snubbing pressure will be 4950/3.141 = 1575 pounds per square inch.

Having determined the cylinder diameter we can now calculate the oil flow through the orifice and the orifice diameter.

Using the same orifice flow formula we used previously we get:

$Q = 95\ A_o \sqrt{P}$ For oil corresponding to MIL-O-5606 where $\rho = 0.031$ lbs. per cubic inch

then $A_o = Q/95\ \sqrt{1575} = Q/3765$

To get the value of A we must determine the oil flow through the orifice at various points of the stroke. The oil flow must equal the piston area (Ap) multiplied by the piston velocity at any given instant. The required piston velocity can be calculated from the expression:

$V^2 = 2as + V_o^2$

Where V piston velocity
a acceleration
s distance from start of snubbing stroke
V_o velocity of piston at start of snubbing

Substituting this equation for piston velocity and

Rod End Snubbing

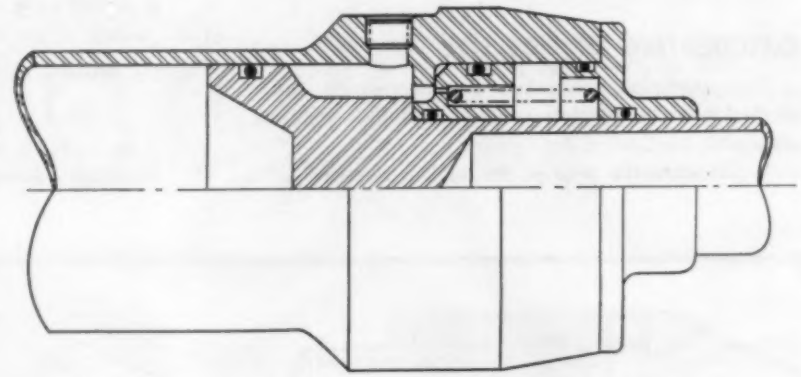


FIG. 6. OIL TRAPPED back of the auxiliary piston is forced through the orifice to provide snubbing.

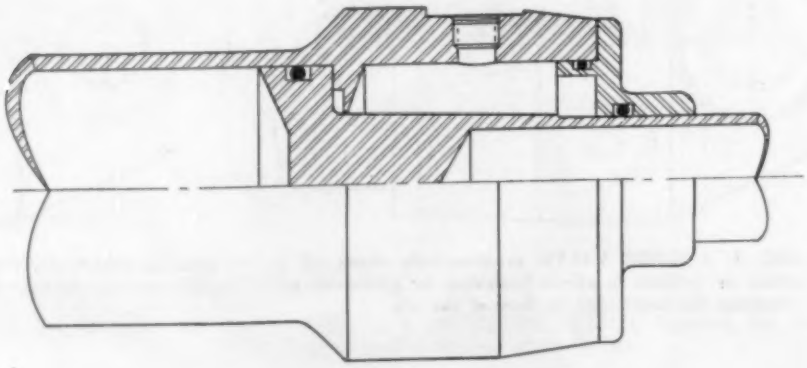
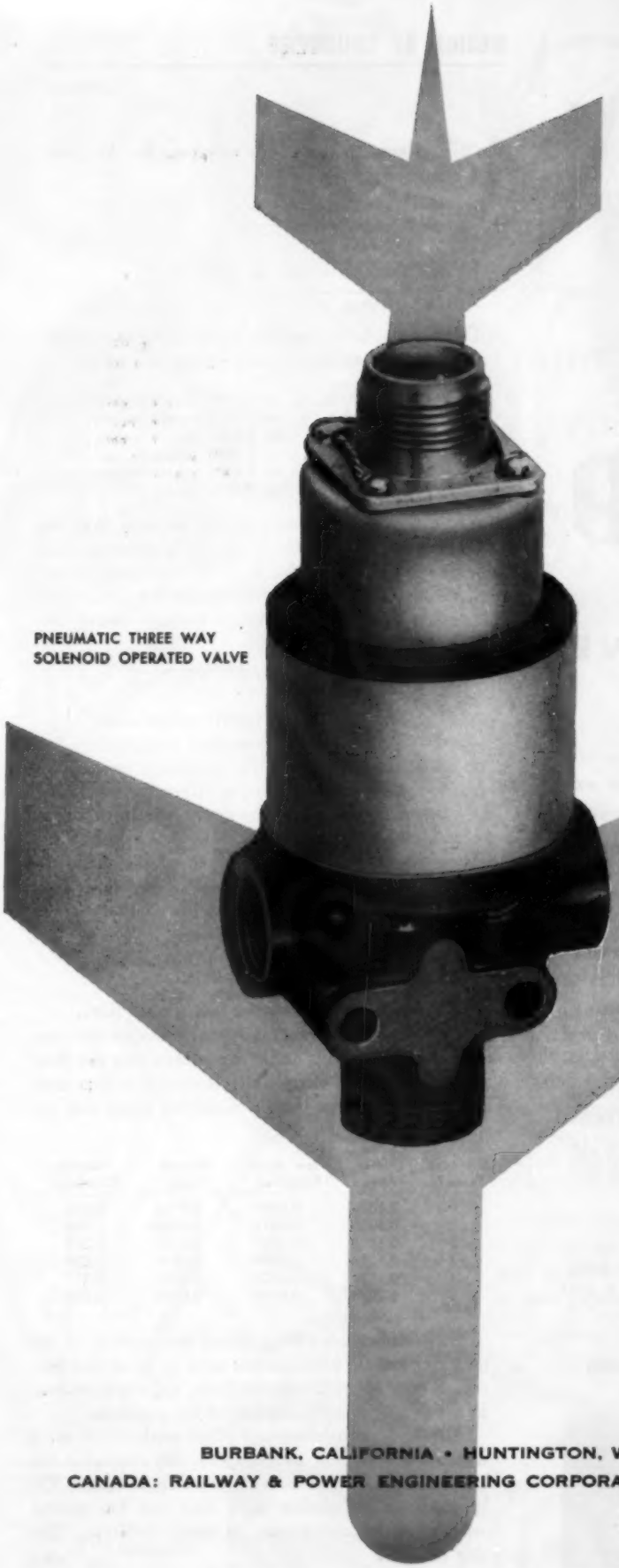


FIG. 7. PISTON ROD is contoured to act as a metering needle, restricting the flow of oil through the annular orifice.



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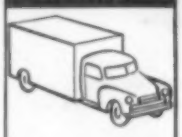
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DESIGN OF SNUBBERS

Continued

the piston area in the above equation for A_O (orifice area) we get:

$$A_o = \frac{Ap \times 12 \sqrt{2as + V_o^2}}{3765}$$

$$= \frac{2.76 \times 12 \sqrt{2 \times 127s + 10.3^2}}{3765}$$

Calculating A_O for various points along the needle, or in other words, for various values of s we get:

s = 0	A_o = 0.0905 square inches
= 1	= 0.0812 square inches
= 2	= 0.0707 square inches
= 3	= 0.0584 square inches
= 4	= 0.0425 square inches
= 5	= 0.000 square inches

From the above figures it can be seen that the final orifice area is zero. It can be appreciated that this is impractical to do, so it is customary to assume some nominal final velocity for the piston, say six inches per second. The flow through the orifice at this assumed velocity is:

$$Q = 2.76 \times 6 = 16.5 \text{ inches}^3 \text{ per second}$$

Then the final orifice area is:

$$A_{final} = 16.5/3765 = 0.00438 \text{ square inches}$$

Having calculated the necessary orifice sizes for the various points along the metering needle, we have to now assume a size for either the needle or the orifice at the start of the snubbing. In this case we will assume a pin diameter of 0.125 inches for ease of manufacture. To the area of the metering needle we must add the required orifice flow area at the start of snubbing to get the actual orifice area required.

Orifice area = needle area + flow area
= 0.0123 + 0.0905
= 0.1028 square inches

Diameter of orifice for this area is 0.362 inches

Knowing the orifice area we can obtabin the contour of the metering needle by subtracting the flow area required (as calculated) from the orifice area and calculating the needle diameter from this resultant area.

Distance From Tip	Orifice Area	Flow Area Required	Needle Area	Needle Diameter
0	0.1028	0.0905	0.0123	0.125
1	0.1028	0.0812	0.0216	0.166
2	0.1028	0.1707	0.0321	0.202
3	0.1028	0.0584	0.0444	0.238
4	0.1028	0.0425	0.0603	0.277
5	0.1028	0.0044	0.0984	0.354

These dimensions fully define the contour of the metering needle which, when used in an orifice having an area of 0.1028 square inch, will snub the load as set forth in the statement of the problem.

Although there are many other methods of using hydraulic cylinders as snubbers, the examples discussed in this article cover typical applications. The methods of calculation used here can be applied, with minor modifications, to many different cylinder designs. ▼▼▼

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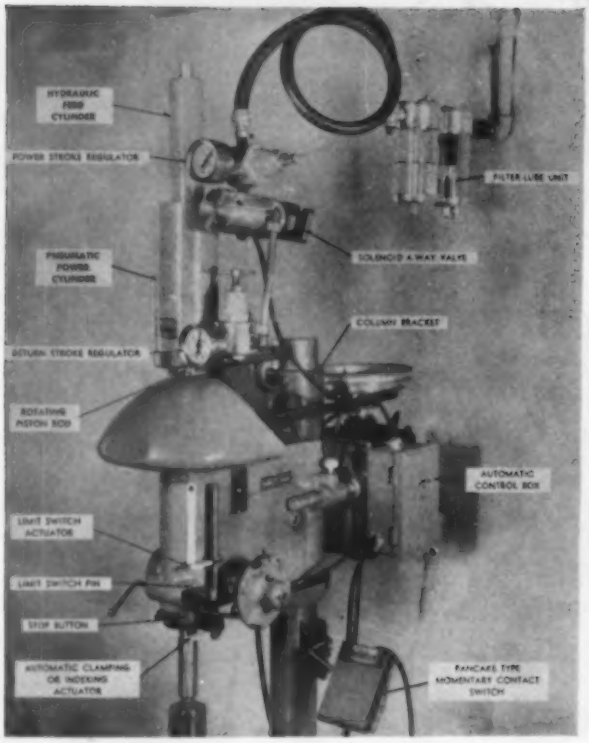

VIEW SHOWS SIMPLE controls required for system. In-line mounting eliminates complex mechanisms. Separate pressure regulator and gages at ports of air cylinder provide differential pressure for power and return strokes. Air cylinder bore is sized to permit operation at 40 to 60 psi air pressure.

In-line power feed design combines . . .

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• By A. L. Caplan

ONE of the most fertile fields for cost reduction in many plants is the automation of countless numbers of manually-fed production drill presses. The installation of a power feed attachment on these drill preses results in increased production and reduced costs.

With this in mind, a new air-oil drill feed has been developed to incorporate the following features:

a. Direct in-line mounting over the spindle to eliminate mechanical losses inherent in side-mounted, rack-and-pinion type feeds. This permits retention of the drill press handle for manual operation.

b. Large thrust capacity to permit normal drilling operations in the 40 to 60 psi range. This leaves a reserve capacity for multiple spindle operations.

c. Instantaneous approach and return. Hydraulically-controlled feed through the work.

d. Simplicity in setting up.

e. Protection against production operator changing hydraulic feed adjustment.

f. Use of a solenoid valve mounted directly at the power stroke port of the cylinder to eliminate piping problems and unnecessary time lag in the line between the valve and the cylinder.

g. Incorporation of a differential pressure system to eliminate waste of high pressure on the return stroke.

For in-line mounting, various flange adapters and column brackets have been developed to permit

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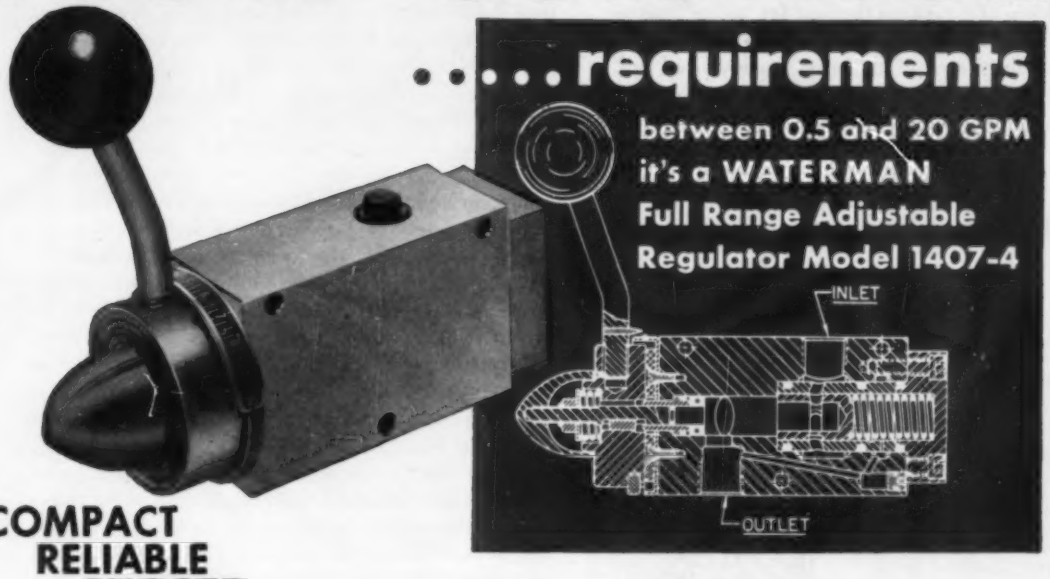

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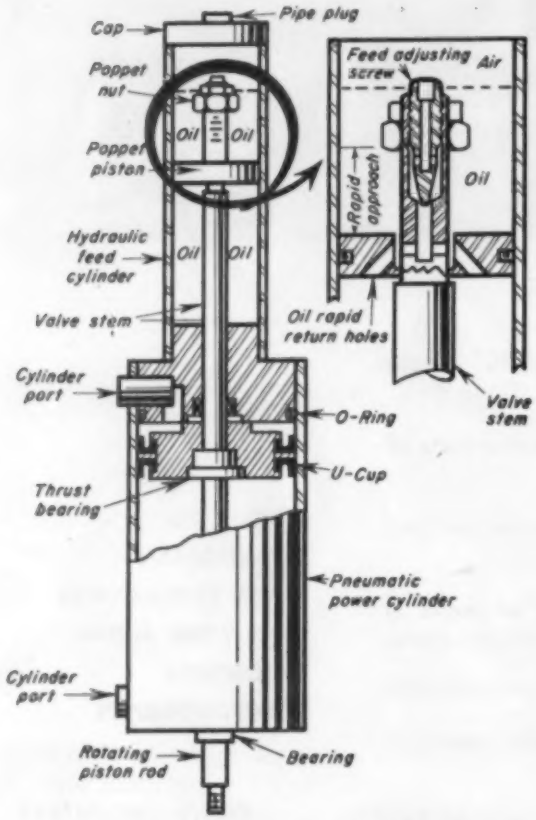
mounting the feed unit on a variety of drill presses. One problem of designing the feed for in-line mounting was that of attaching the piston rod to the drill press spindle. The spindle must be advanced and yet positively retracted without tension springs or counterweights, and attaching the rod to the spindle requires the rod to rotate with the spindle.

These difficulties were solved by drilling and tapping the end of the spindle and screwing the threaded end of the piston rod into it. The other



CROSS-SECTION of feed mechanism.

end of the piston rod is mounted in a high-thrust capacity ball bearing housed in the piston. A special air seal permits simultaneous rotation and reciprocation of the piston rod. The threaded end of the rod operates in an oilite bearing.

The hydraulic feed unit regulates the progress of the drill through the stock and eliminates the sudden surge inherent in air cylinders when the load is removed as when the drill point breaks through. The air space above the oil permits constant venting of the fluid to the atmosphere, eliminating the possibility of "trapped air". This eliminates expansion and make-up fluid chambers and the need for special oil injection tools. Special seals prevent oil from entering the air cylinder and vice versa.

Basically the hydraulic control unit is a poppet-type flow control valve with controlled flow on the power stroke and free flow on the return stroke. The poppet seat is metal-to-metal providing positive-sealing action. This seal is made during feed when the poppet nut bears against the poppet piston. The poppet valve stem has an integral adjustable orifice for "metering-out" fluid control, permitting infinitely variable hydraulic feeds. The return stroke is rapid, because the poppet nut is immediately unseated to permit free displacement of oil through the four angular holes in the piston. On the return stroke the shoulder on the stem engages the piston, to return it to its starting position. The stem is positively assembled to the air cylinder piston which is non-rotating.

To adjust the length of rapid approach, the cylinder cap is removed and the poppet nut is moved up or down the threaded valve stem. The drill press handle is used to check for proper drill point clearance at the end of the approach stroke. The poppet nut is then locked in position. The hydraulic feed adjustment is made by turning the feed adjusting screw clockwise or counterclockwise with an Allen wrench.

The differential pressure requirement is met by the use of individual pressure regulators and gages at each cylinder port. Experience has shown that 10 to 15 psi is sufficient to return the spindle, effecting a large savings in air consumption and a reduction in compressing equipment load and wear.

A compact solenoid 4-way valve for in-line mounting at the cylinder port has been designed for the feed unit. The valve is a solenoid, spring-return, spool-type with a cylindrical body. A full floating spool is used, and there is no metal-to-metal contact between the valve body and the valve spool. Bearing support for the spool is provided by the O-ring seals. The action of the O-rings provides constant lapping of the spool surface, giving extremely long leak-proof service. The body and spool are machined from aluminum bar stock. Oversize exhaust ports permit instantaneous dissipation to the atmosphere.

The feed is initiated by pressing a momentary-contact, push-button switch. This closes a relay that energizes the solenoid until the limit switch is tripped. Rapid approach is made at impact hammer speed, then hydraulic feed takes place until the limit switch is tripped. Drilling depth is set by moving a limit switch tripping plate up or down the depth-stop rod of the drill press. The tripping plate is then locked with knurled nuts. Repetitive accuracy in depth of drilling is less than .005 inch. The use of a time delay unit providing a momentary dwell against a positive mechanical stop gives an accuracy of less than .0005 inch. ▼▼▼

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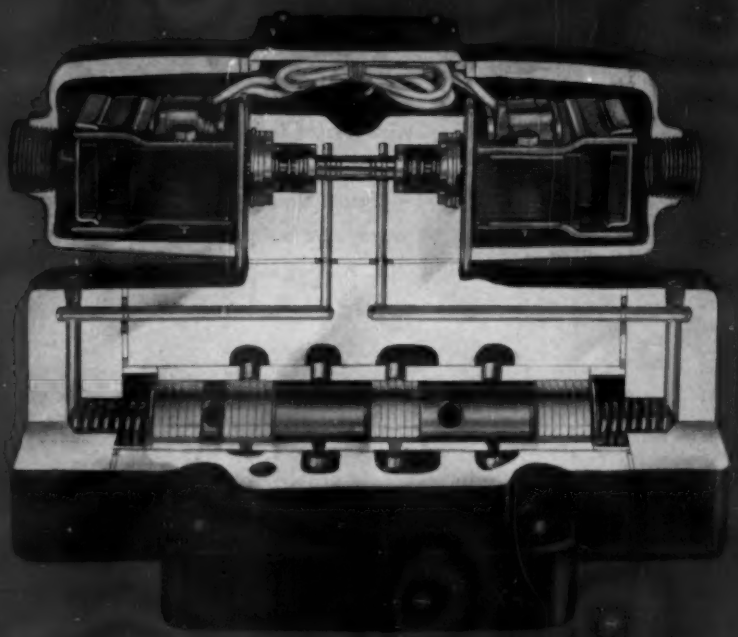

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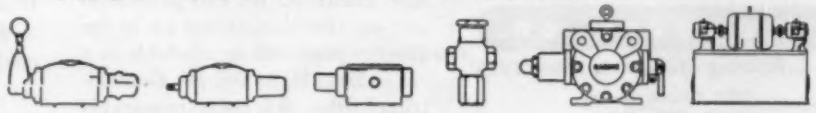

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Ideas from a Sales Engineer

Elmer F. Heiser

Elmer Heiser, who is associated with S. G. Morris in Cleveland, has spent 18 years selling air and hydraulic components to industries in northern Ohio. During these years he has encountered innumerable situations, many of which he says "relate to fluid power, people and problems". We've asked Elmer to tell you about them in a monthly column. He is the author of the recently published *"Air and Oil Cylinders for Industrial Applications"*. We're sure that you will find valuable this opportunity to borrow from Elmer's experiences—which he treats amusingly in both words and cartoon.

When should you use air or oil?

"We have an air problem."
"We have a hydraulic problem."
"We have a problem."

To the sales representative for air and hydraulic equipment such words have about the same effect as the clanging bell on ye old fire horse. Very often the third statement is the true one even though one of the other two may have been offered first. This brings up an interesting point for conjecture. When is a problem relating to the application of fluid power a hydraulic problem and when is it a pneumatic problem? Can we draw a line or establish a simple set of rules or standards which can be used for measuring and classifying a problem? If we assume that such standards can be set, where would we start?

The most obvious difference between air and hydraulic mediums is without doubt the working pressure available. We can generalize and say that compressed air in the average plant will be available in a range from 80 to 100 psi. Generalizing further, it is not unreasonable to pick 750 to 1000 psi as a comfortable average oil hydraulic pressure. Air installations in a plant will usually be figured on the basis of the air pressure already available. Since oil hydraulic installations usually are individually powered, we are not limited to the 750-1000 psi average. We can go to 2000-3000 or 5000 psi and upward for new installations.

With the wide difference in available pressure (pneumatic versus hydraulic) perhaps we should make the force or power requirement the determining factor and somewhere, somehow set a line. Could we take the 80 psi figure, multiply it by a reasonable area figure and thereby get a line? If this answered the purpose, we could settle on perhaps 20 square inches and arrive at a 5 inch bore cylinder. This would mean our force line would be somewhere from 1500 to 2000 pounds.

What's wrong with that? We could even go further and try to

Continued on page 94

DO YOU KNOW WHY

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Ideas from a Sales Engineer

Continued

justify the figure by a claim that, on the basis of relative efficiency, compressed air must obviously drop out of the picture somewhere along about here.

Is Force Figure Enough?

Now we're all set. On any new problem if the total force required is 2000 pounds or over, we will power with oil; if under 2000 pounds, we'll make it an air job. Pretty simple. It's probably too simple and could get us into trouble if set up as our universal standard.

Perhaps with this force figure as a rough basis it would be practical to throw in a couple of other considerations and come up with a more usable standard. What should it be?

Speed seems important. We know that hydraulic equipment to match the speed of air powered movement can get a little awkward. Big pump, accumulators, large lines, valves, etc. don't seem too sensible if air will give us more snap than we need.

Another consideration might be that of control. We know that infinite control of speed and position is old hat hydraulically but can become a terrific problem when air is used.

It might be a good idea to toss in a couple of additional considerations to prevent our measuring device from misleading us. Where will this new piece of equipment be installed? Is compressed air available? If we make it hydraulic when everything else in the particular plant is air operated, will a new set of maintenance problems be introduced? Maybe there is a related piece of equipment with a hydraulic system on standby in the cycle so the new one can be connected to the old without an additional pump or reservoir.

It begins to look like so many conditions must be added to any rule or set of rules that it becomes more than a little indefinite. Why not start over; throw out any set rules and just say that selecting air or oil is a matter of judgment. After so many words we finish at the same place we started.

"Somebody says he's a hydraulic engineer"

There is a vast difference in how fluid power problems are presented to the sales engineer. One fellow will just say he has a problem and will ask that you see him to discuss it. Another will say "I'm going to use your pump on a job, what size motor does it take to drive it?" No matter how delicately you edge around to get some facts on which to base your answer he thinks you're too darn nosey. I recall one such conversation when I never did get to answer his question and he let me know what an inquisitive but stupid dope I was. Maybe he's right. I can't answer a simple question like "What size motor is required to pump oil at pressure?" ▼▼▼

Next month:

Some simple questions need long answers.

What he needs is a

STAFFA HYDRAULIC RAM!

Staffa Rams are available in four standard ranges: high and low pressure solid, high pressure hollow and tubby rams. Loads from 1 to 150 tons. Pressures up to 5,000 p.s.i., strokes up to 36". Higher pressure and larger stroke rams are made specially.

For rams, pumps and all other hydraulic equipment write to Chamberlain Industries Ltd. Staffa Works, Staffa Road, Leyton, London, E.10.

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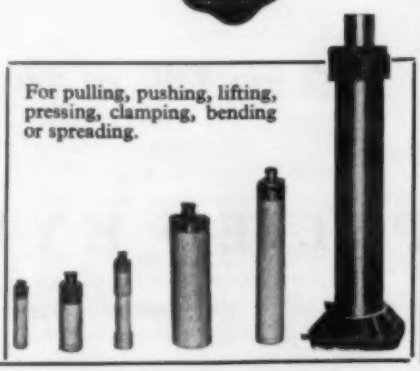

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Useful Literature

continued

HOSE COUPLER . . . A machine for preparing hydraulic hose complete with couplings is presented in a brochure by Champ Industries Div. of Hose Accessories Co. The machine cuts the hose to length, performs the skinning operation, and installs the adapter. Hose of ¼, ⅜, ½, ¾, 1, and 1¼ inch sizes can be handled by the machine.

Circle 133 on Reader Service Card

PRESSURE REGULATING VALVES . . . are featured in Bulletin PM-1 which can be obtained from Foster Engineering Co. The valves were developed to control pressure in plastic molding. Type 40H is recommended for installations where all fluid must flow through the valve. The valve is intended for initial pressures up to 4000 psi and gives regulated pressures from 150 to 2500 psi. Type 40H1 is used on two-pressure systems, or where press closing time is not critical.

Circle 134 on Reader Service Card

OIL FILTERING UNIT . . . A portable oil reconditioning unit for removing solids, gums, varnishes, acids, water, and emulsions is announced in a bulletin from the Mayhew Products Co. The unit can be used as a filter, reclaimer, transfer pump, circulating pump, engine or machine de-sludger, flushing machine, or any combination, and can be used whether oil is in or out of service, in machine sumps, reservoirs, tanks, or barrels.

Circle 135 on Reader Service Card

HOSE CHECK LIST . . . to help obtain longer hose life and better performance is offered by the Thermoid Company. Printed on stiff cardboard for wall mounting, the eleven-point check list uses drawings to high-light four common abuses of hose.

Circle 136 on Reader Service Card

FLOW TRANSDUCER . . . which translates fluid friction acting on a streamlined body immersed in the flow stream into an electrical output is described in information from Ramapo Engineering Co. The transducer contains no precision bearings, packings or bushings, bellows, pistons, or auxiliary fluids and combines simplicity, ruggedness, and an accuracy of better than 1%. The sensitivity of the transducer makes it ideally suited for measurement of transient flows with high speed recording devices.

Circle 137 on Reader Service Card

HYDRAULIC COMPONENTS . . . manufactured by Oswalds and Ridgway Ltd. are specified in data sheets issued by the company. Components covered include high and low pressure swashplate pumps, high pressure unloading valves, pump and tank units, cylinders, and other types of valves.

Circle 138 on Reader Service Card

Continued on next page

COMPARE 20 OZ. PER MINUTE INTERNAL LEAKAGE IN THE MOST WIDELY USED TYPE OF VALVE
AGAINST 10 DROPS IN A BARKSDALE SHEAR-SEAL VALVE —SAME SIZE AND CONDITIONS—AND ZERO EXTERNAL LEAKAGE

INTERNAL VALVE LEAKAGE COSTS MONEY

There is a direct ratio between the amount of leakage in a valve and the expense from it.

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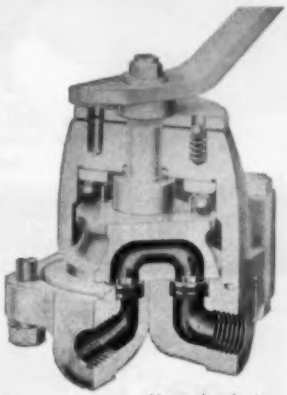
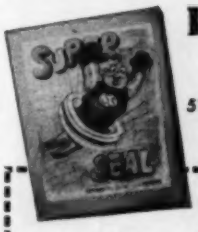


Manual selector and shut-off valves vacuum to 6000 PSI

Higher, yet hidden damage results when leaky valves constantly exhaust accumulators, overwork pumps and compressors, or increase the scrap rate through loss of working pressure.

Furthermore, leakage creates heat in your hydraulic system accelerating wear and deterioration in costly machinery and components. Ironically, the valves are often overlooked as the real culprit in such failures.

For greater operating economy and lower overall maintenance install leakproof Shear-Seal valves.



BARKSDALE VALVES

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Send FREE bulletin "Super Seal Explains the 'Shear-Seal' Principle."

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Circle 20 on Reader Service Card

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For example—This Century designed and built Power Unit. 50 H. P. motor drives variable delivery pump with maximum output of 20 gpm at 5000 psi. Century reservoir is 125 gal. capacity.

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★ Heavy grey iron casting, accurately machined surfaces.

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This useful, high quality No. 80 SPEEDY AIR PRESS is the last word in air power engineering—the result of 34 years of specialization in diaphragm compression. Extremely sturdy, it does dozens of jobs formerly handled by expensive presses—and does them more quickly, easily and economically. Operated by Speedy Foot Control, Hand, or Fingertip Valves. Order from your supplier or write direct.

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AIR TOOLS • AIR VALVES • AIR REGULATORS • FILTERS • CONTROL UNITS

Useful Literature continued

AIR VALVE . . . which can be connected to the rear or side ports of cylinders provides directional control and is actuated either by solenoids or pilot air. Integral speed throttles are of the balanced type and give smooth hydraulic-like action to air cylinders at slow speeds. The valve manufactured by Airelectric Corp. uses a D-slide principle and offers a multi-million cycle life. The wear parts can be renewed for 25% of the original cost. Catalog sheets are available.

Circle 160 on Reader Service Card

SHAFT SEALS . . . Methods for sealing all types of rotating shafts are described in Bulletin 10 offered by Sealol Corp. The five standard seal designs discussed handle a wide range of difficult sealing applications such as pressures to 1000 psi, temperatures to 450°F, shaft speeds in excess of 3600 rpm, and conditions involving corrosive fluids. The seals are supplied for replacement of present shaft packings or for installation as original equipment.

Circle 161 on Reader Service Card

TITANIUM TUBING . . . Tubing of titanium is described in Bulletin 43 just published by Superior Tube Co. The excellent strength-weight ratio of titanium promises a bright future in the aircraft field where one use is for hydraulic lines. Lengths up to 24 feet are available and it is recommended that the

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Has fine ground lenses of optical glass. Neutralizes eye strain from close work. Binocular design gives third dimensional vision. Allows freedom of both hands. Wear over glasses. Plastic frame with adjustable headband.

SIZES: 20" focal lgth., 1¾ power — 14" focal lgth., 1¾ power, 10" focal lgth., 2½ power, 8" focal lgth., 2¾ power . . . . . prices each ONLY 10.50

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See our complete line. Pullers for Gears, Bearings, Wheels, Pulleys, Bushings, Shafts, etc.

NEW 10 TON HYDRAULIC PRESS

Use this Press in the Shop or take it with you on the job. Frame is 4" welded channel iron. Has 48" stroke, 23½" diam. ram. Valve operates piston in both directions. Adjustable platform. Positive power Hand Pump with handle. 3000 PSI pressure gauge. SIZE: 60" high, 27" wide, 29" base. 129.00

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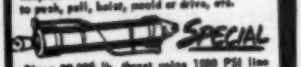
We stock over 100,000 Hydraulic Cylinders in 106 different types and sizes. These can be adapted wherever tremendous power is needed to push, pull, hoist, mould or drive, etc.



SPECIAL

Gives 28,000 lb. thrust using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on a low pressure air system. Has 4" bore; 18" stroke; 30½" long. Ideal for shop. Part No. 29 NEW 43.95 29.95

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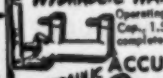

Operating pressure 1500 PSI. Cap., 1.5 cu. in per complete cycle . . 12.75

ACCUMULATORS

A-2B FLOATING PISTON TYPE — 4"x 18" Built to stand 2,000 PSI 12.75

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Circle 15 on Reader Service Card

Circle 77 on Reader Service Card

tubing be used with flareless type fittings, especially a new compression fitting with a collar which is pressed into the tube to effect a seal with the body of the fitting.

Circle 162 on Reader Service Card

AIR-OIL CYLINDER . . . which combines the long stroke and fast action of the pneumatic cylinder with the positive action and force multiplication of the hydraulic cylinder is described in a 16-page bulletin No. 61763 by Pantex Manufacturing Corp. Applications for the cylinder include clamping, closure, compression, extrusion, squeezing, and crushing in such processes as laminating, molding, veneering, testing, rolling, calendering, etc. Complete installation data are given on the 2100 lb and 5600 lb units.

Circle 139 on Reader Service Card

PISTON PUMP . . . with variable discharge from 0 to 110 gpm in either direction is featured in Bulletin No. 3 released by American Engineering Co. The radial piston pump has tapered roller bearings to assure long dependable service and an attached pilot pump to eliminate a second drive. Some recommended applications of the pump are heat treating furnaces, riveting machines, broaching machines, and reversible variable speed transmissions.

Circle 140 on Reader Service Card

SUBMINIATURE SWITCHES . . . A new 12-page catalog covering subminiature, snap-action, precision switches has been published by Micro Switch Div. of Minneapolis Honeywell Regulator Co. This catalog No. 75 gives complete information on the standard subminiature (single-pole, double-throw) basic switch as well as the high temperature and turret terminal versions. Material presenting auxiliary actuators to adapt the switches for actuation by cams and slides is included.

Circle 141 on Reader Service Card

AIR AND HYDRAULIC COMPONENTS . . . including cylinders, valves, accessories, and machines are presented in a catalog released by Magicair Div. of Pneumatic Products, Inc. Package unit machines offered include air squeeze-type and impact presses, air-hydraulic drill press and milling machine feeds, kick press pneumatic kit, and radial saw feed.

Circle 142 on Reader Service Card

O-RINGS . . . from silicone rubber are included in Supplement B to the data handbook prepared by the Acushnet Process Co. The publication outlines the history, applications, and properties of silicone rubber and illustrates some of the products now being fabricated from this material.

Circle 143 on Reader Service Card

PNEUMATIC POSITIONER . . . is a transducer for converting pilot air pressure into mechanical position of its cylinder. The unit, designed for use in closed-loop control, is readily adaptable for control on motor driven speed changers, proportioning pumps, and a wide variety of valves not previously adaptable

Continued on next page

Circle 38 on Reader Service Card

Exclusive with
GERBING FLEXIBLE COUPLING!

CONCAVE JAW SURFACES

The concave jaw surface of the new Gerbing Flexible Coupling actually holds the resilient synthetic rubber insert or spider in position, thus eliminating any tendency of the rubber to break or extrude. Capable of handling peak loads, shocks and overloads. Instantly compensates for angular and parallel misalignment.

Available for shafts ½" to 1⅞" and H.P. ranges from fractional to 25. Standard keyways are provided. Deliveries from stock.

Write for details

. . . hold spider in position at all times —No extruding!

NO BREAKING OF SPIDER

CLOSE CONCENTRICITIES ASSURE VIBRATION-FREE OPERATION

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a manual
SHUT-OFF VALVE
that doesn't leak

- "O" Ring seal for dead tight shutoff
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CIRCLE SEAL *precision valves*

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Useful Literature continued

as control valves. The positioner which uses design based on balanced air pressures acting on a piston, can develop thrusts of 5000 lb while holding a position within .002 inch. Information on the pneumatic positioner is contained in Bulletin B-50-2 prepared by Conoflow Corp.

Circle 144 on Reader Service Card

HYDRAULIC CYLINDERS FOR AGRICULTURE . . . Catalog sheets from Cross Manufacturing Co. include information on hydraulic cylinders with depth control for farm implements. The screw collar stop can be set for any length stroke from 4½ to 8 inches for farm implements requiring accurate, positive depth control or easy lowering, lifting, and positioning. The cylinders have a maximum working pressure of 1200 psi.

Circle 145 on Reader Service Card

HOSE . . . including pneumatic tool hose, hydraulic hose and fittings, has been described in material issued by Gates Rubber Co. High pressure hydraulic hose for lines subject to shock loads and heavy pulsating pressures is listed for pressures from 1000 to 2500 psi. This hose is designed for use through temperatures from −40° to 200°F.

Circle 146 on Reader Service Card

GROOVE GAGE . . . The Meuller Laboratory offers a 6-page folder on a gage for O-ring grooves and snap ring grooves and bores. The range of the gage is .187 to 2.250 inches and it is ideal for close tolerance inspection. Operation of the light-weight, pistol-grip gage is described in detail, and gaging specifications for both O-ring grooves and snap ring grooves are included.

Circle 147 on Reader Service Card

AIR-HYDRAULIC PUMP . . . converting high-volume, low-pressure air to high-pressure oil is featured in a brochure prepared by the Powermatic Sales Co. Oil pressure up to 18,850 psi can be developed by using 150 psi air pressure. The 4-page brochure lists specifications for several models and indicates applications for the pump.

Circle 148 on Reader Service Card

HYDRAULIC BENDER . . . A new 15-ton bender using a two-speed hydraulic pump is described in literature available from Greenlee Tool Co. Full 90-degree bends can be made with one stroke of the ram, and the bender can be used for pipe, tubing, bus bar, and all types of conduit.

Circle 149 on Reader Service Card

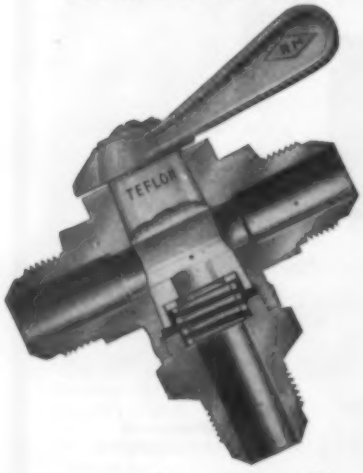
HYDRAULIC STEERING SYSTEM COMPONENTS . . . are described in bulletin M-5106 prepared by Vickers, Inc. The bulletin presents standard Vickers units for developing a wide variety of hy-

NEW!

REPUBLIC SELECTOR VALVES

NEW!

"LO-TEMP"
−65° without lubricant



"LO-TORQ"
6000 psi service

LO-TORQ SELECTOR
BALANCED PRESSURE FOR EASY TURNING

With service pressure and seals on both sides of valving disk, turning is easy. Design is simple—maintenance is low. Many services—Air, and gas 4000 psi; fuel, hydraulic oil, petroleum, water, 6000 psi. Made in bronze, semi-steel, aluminum alloy, in three different portings, ⅛" to 1". Request Bulletin No. 454.

LO-TEMP SELECTOR

Teflon plug ends the need for lubricant. Easy turning—non seizing. −65° to 250°F. 2- 3- 4-way. 100 psi service. Made in aluminum alloy or stainless steel. ⅛" to 1" pipe or tube. Request Bulletin No. 754.

145

RM

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draulic power steering systems for trucks, busses, material handling and other commercial type vehicles. The components include the new S-23 series power steering boosters, vane-type power steering pumps, combination volume control and overload relief valves, and oil reservoirs. The bulletin includes circuit diagrams showing four types of power steering systems. In addition typical applications of hydraulic boosters showing frame and steering column mounting are presented.

Circle 150 on Reader Service Card

ROTARY COMPRESSORS AND VACUUM PUMPS . . . are explained and listed in a catalogue from Rotary Compressors Ltd. The material presents the principles of operation of these units which are capable of producing pressures of 45 psi and vacuums of 29.0 in. Hg. Using two meshing rotors inside a housing, the units require no cylinder lubrication and consequently are able to deliver oil-free air.

Circle 151 on Reader Service Card

ROTARY LIMIT SWITCH . . . among whose recommended uses are on presses and valves is described in a brochure by Gemco Electric Co. The limit switch connects directly to a rotating member to be limited and incorporates a worm gear and cam arrangement to trip an internal limit switch. Mounting dimensions, specifications, and prices for the limit switch are given.

Circle 152 on Reader Service Card

ELECTRIC MOTORS . . . U. S. Electrical Motors, Inc. has released their new bulletin No. 1868 illustrating vertical solid shaft motors from ¼ to 400 horsepower. The motors are ventilated by the down draft system which insures that the warm exhaust air cannot be mixed with the cool incoming air. A choice of two types of face brackets permit direct mounting to driven machines.

Circle 153 on Reader Service Card

HYDRAULIC CYLINDERS . . . manufactured by Turlock Iron and Machine Works are listed in their catalog No. 854. The 8-page catalog presents information on several series of cylinders representing various designs. Dimension drawings and design information are included.

Circle 154 on Reader Service Card

CHECK AND FLOW CONTROL VALVES . . . Specifications on air and hydraulic valves manufactured by Rivett Lathe & Grinder, Inc. are available from the company. Giving dimensions and sectional views, the information covers flow control valve with internal check, pilot operated check valves, and pilot operated check valves with pressure breakers.

Circle 155 on Reader Service Card

BELT DRIVES . . . Worthington Corp. offers a new Master Engineering Manual on their Multi-V-Drive line. The new 100-page manual, designated V-1400-E2F, presents a scientific and simplified method for rating V-belts. Each popular 60-cycle motor speed with complete drive selections is shown on separate

Continued on next page

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
Flange Mounted — "O" Ring Seal

A—JIC Flare Tube Fittings
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You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

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Circle 87 on Reader Service Card

Low-cost ready-made hydraulic tanks

top-notch DESIGN

large top SURFACE

a complete LINE

all tanks IN STOCK

ALL WELDED construction

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Attention Dealers—write us for more information.

Rosaen Reservoirs do away with makeshift, unsightly home-made construction, give you instead a ready source for standardized, properly engineered reservoirs and all mounted accessories. Produced in volume, the price beats building or buying them to special order. All parts carried in stock.

The Rosaen Company will also assemble complete power units to order, and supply all hydraulic components if desired.

The ROSAEN COMPANY
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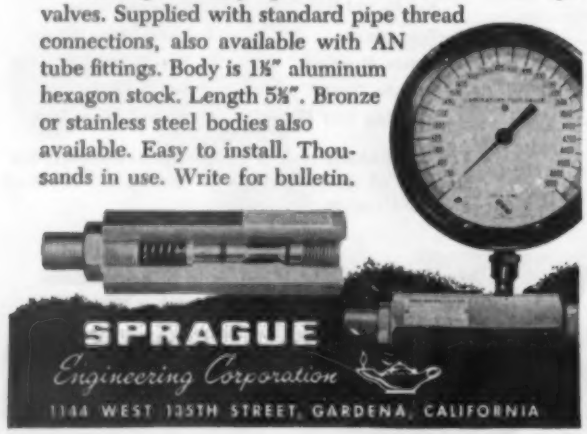
PROTECT
EXPENSIVE GAGES

SPRAGUE SHUT OFF VALVES automatically cut out gages and other pressure-sensitive instruments when fluid pressures go beyond their operating limits. Automatically open when pressure is again within approx. 80% of set cut-out points. Available for any pressure setting between 10 PSI. and 5000 PSI. Save valuable man hours. Eliminate opening and closing manually operated shut off valves. Supplied with standard pipe thread connections, also available with AN tube fittings. Body is 1⅛" aluminum hexagon stock. Length 5⅛". Bronze or stainless steel bodies also available. Easy to install. Thousands in use. Write for bulletin.



SPRAGUE
Engineering Corporation
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Useful Literature continued

pages. A table on drive selections contains nearly every possible stock sheave combination, and each belt column in the table section has its own series of arc and length correction factors.

Circle 156 on Reader Service Card

CYLINDERS . . . A detailed, illustrated description of the new "S" series of cylinders is given in a new catalogue issued by the Hydro-Line Manufacturing Co. Various types of mounts are shown for cylinders from 1½ to 8 inch bores. The cylinders are rated for pneumatic pressures up to 200 psi or hydraulic pressures up to 1000 psi.

Circle 157 on Reader Service Card

COUPLINGS . . . Titeflex, Inc. offers a new catalog of their quick-seal couplings which are designed for leak-proof performance and have full swivel action. The couplings require no tools for coupling or uncoupling. Information on straight-through couplings, check valve couplings, and accessories is included. A complete line of straight-through, single check and double check valves from ¼-inch to 12-inch in all sizes is available.

Circle 158 on Reader Service Card

AIR OPERATED VALVE . . . Seely Instrument Co., Inc. presents a 4-way diaphragm valve in their catalogue sheets A-7 and A-8. The seats of the valve are of hard monel, and for hand operation, the valve has a small, easily operated air valve.

Circle 159 on Reader Service Card

Speed Control

Continued from page 64

rather than absolute speed control. In most applications the relative speeds of each roller with the one before is more important. An extension of the Keelavite system can be used for this purpose as illustrated in Figure 9. A pump is driven from each roller and all pumps are connected in series. Any relative change of speed causes a corresponding change of pressure in the line, and this operates the spill-off valve in the main motor circuit.

PUMP-MOTOR CONTROL

An American treatment of the same problem was described by Ransom Tyler (Applied Hydraulics, July 1954 page 64). In a simple scheme for coordinating two shafts, Figure 10, shaft No. 1 is driven at a constant speed and drives a small variable delivery pump, PV-1 which is hydraulically connected to a fixed delivery motor, MF-2, driven by shaft No. 2. If shaft No. 2 speeds up. MF-2 acts as a pump, and if the shaft slows down, MF-2 acts as a motor. The

main difference between the two systems is that this method uses a variable delivery pump for the main drive, instead of a fixed delivery pump with relief valve.

MULTIPLE SHAFT CONTROL

A system to control any number of shafts, Figure 11, has all the control pumps and motors in series. Variations of pressure in the connecting lines actuate the speed controls of the main driving pumps.

▼▼▼

Hoist Transmission

Continued from page 60

rect current with alternating current abroad ships in order to increase efficiency and reduce cost and maintenance, another method had to be found for driving winches and other variable speed auxiliaries. Because they are designed to operate with a constant speed input such as is characteristic of an al-

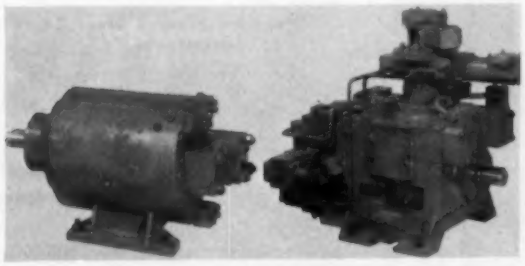


FIG. 2. POWER AND CONTROL of the winch is provided by the variable volume axial piston pump at the right and a fixed displacement axial piston motor. All the directional and load control valves are integral with the pump.

ternating current motor, hydraulic drives furnish a most suitable answer.

A typical hydraulic winch drive is shown in Figure 1. Lake Shore Engineering Co. has built 56 of these winches for installation on two refrigeration ships.

This particular drive consists of the constant displacement motor and variable delivery pump shown in Figure 2. This transmission will develop pressures up to 3000 psi. At 1000 psi, maximum pump delivery is 110 gpm. The volume can be varied from near zero to maximum by actuation of a servo control. With a fixed displacement of 21.7 cu in per revolution the fluid motor, driven by pump volume, offers a speed range in either direction of near zero to 1200 rpm as pump delivery varies over its complete range. Since motor displacement is constant, torque output of the motor depends entirely on system pressure. At 1000 psi, 3150 in lbs of torque are available at the motor output shaft.

▼▼▼

FOR MORE PRODUCTION..LOWER COSTS

Automate YOUR MACHINES with

Pneu-trol

Standard drill press units converted for automatic push-button precision tapping and spot-facing operations. Production increase—400%!

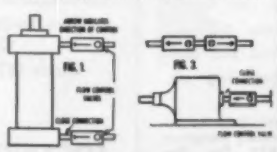
"AUTO-PONENTS"

Pneu-Trol Flow Control Valves and Time Delay Control Switches are *basic automatic components* which permit low-cost conversion of any cylinder operated drill press, arbor press, punch press, etc. to automatic operation. They provide these advantages:

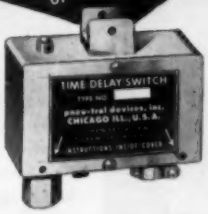
1. **Cylinder (and machine) speed control for safe operation.**
2. **Necessary controlled work cycle delay.**
3. **Less spoilage . . . more production from your present equipment.**
4. **PUSH BUTTON PRODUCTION.**

FLOW CONTROL VALVE FOR CONTROLLED CYLINDER SPEED

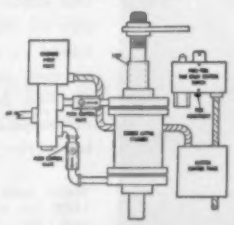
Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control, and a floating retro ball check, which permits full flow in the opposite direction. Design provides close regulation in one direction, full flow in opposite direction. Available in 5 female pipe sizes—¼" to ¾". Valve bodies made of brass, aluminum, steel or stainless steel.



TIME DELAY CONTROL SWITCH FOR PRECISE DELAY OF WORK CYCLE



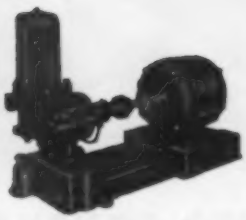
Provide controlled adjustable time dwell of solenoid operated air or oil supply valves. Range between ⅛ and 60 seconds in 20 to 1 ratios. Compact—simple—foolproof—rugged. Easily mounted on machine. Available for various types of actuation. Typical diagram below.



Pneu-trol DEVICES, INC.
Components for Automation
1424 N. Keating Ave., Chicago 51, Ill.

• Since 1925 • In the application, design and manufacture—pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289, for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL CO

305 Williams Ave., Hackensack

New Products continued

TENSIONING DEVICE
. . . with no moving parts

Designation: Clevite Muscle

Design: The device consists of a Neoprene tube secured with compression fittings at each end to a braided Nylon cover. The device is installed so that one end is fixed and the other end is attached to the object to be moved. Air or other fluid is introduced into the tube increasing the circumference and decreasing the length. Thus the device is able to exert a pulling force at its movable end. The maximum stroke of the Muscle is 20% of its length and the length is selected according to the required stroke.

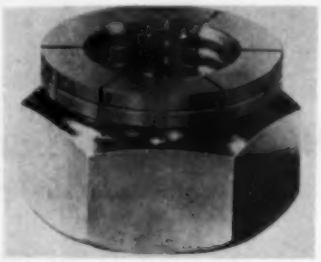
Features: No special tools are required for installation of the Muscle, and no special fittings are needed. The unit requires only enough room for expansion of its circumference. Almost any available source of power will operate the device which functions at low internal pressure. The materials are not subject to stress failure, and the construction protects against chatter, jolts, and bumps. There are no problems of packing, piston seals, misalignment, etc.

Clevite-Brush Development Co.
Cleveland, Ohio

Circle 183 on Reader Service Card

LOCKNUT
. . . for heavy duty

Design: All-metal one-piece design permits the fastener to serve as a stop nut as well as a locknut. Thread design permits nut to secure high pressure without excessive wrenching. Slotted top consists of six equal segments which are closed in to make the inside diameter smaller than the mating



bolt. The nut locks immediately when it is screwed on the bolt and holds tightly at any position without galling.

Specifications: Locknut is supplied in diameters from 1 to 2 inches and is available in alloy steel.

Standard Pressed Steel Co.
Jenkintown, Pa.

Circle 184 on Reader Service Card

TEFLON PACKING
. . . for handling corrosives at high speeds

Design: Packing is tightly braided by a special process to provide density and firmness and to eliminate large voids.

Features: Teflon yarn packing is designed to function at higher peri-

pheral speeds than ordinary braided tape or molded forms of Teflon. Anti-friction qualities of Teflon combined with the softness, resilience, and fluid retentive properties of fine fibre construction enables packing to run cooler than other types. Packing provides excellent anti-corrosive, thermal, and

Continued on page 104

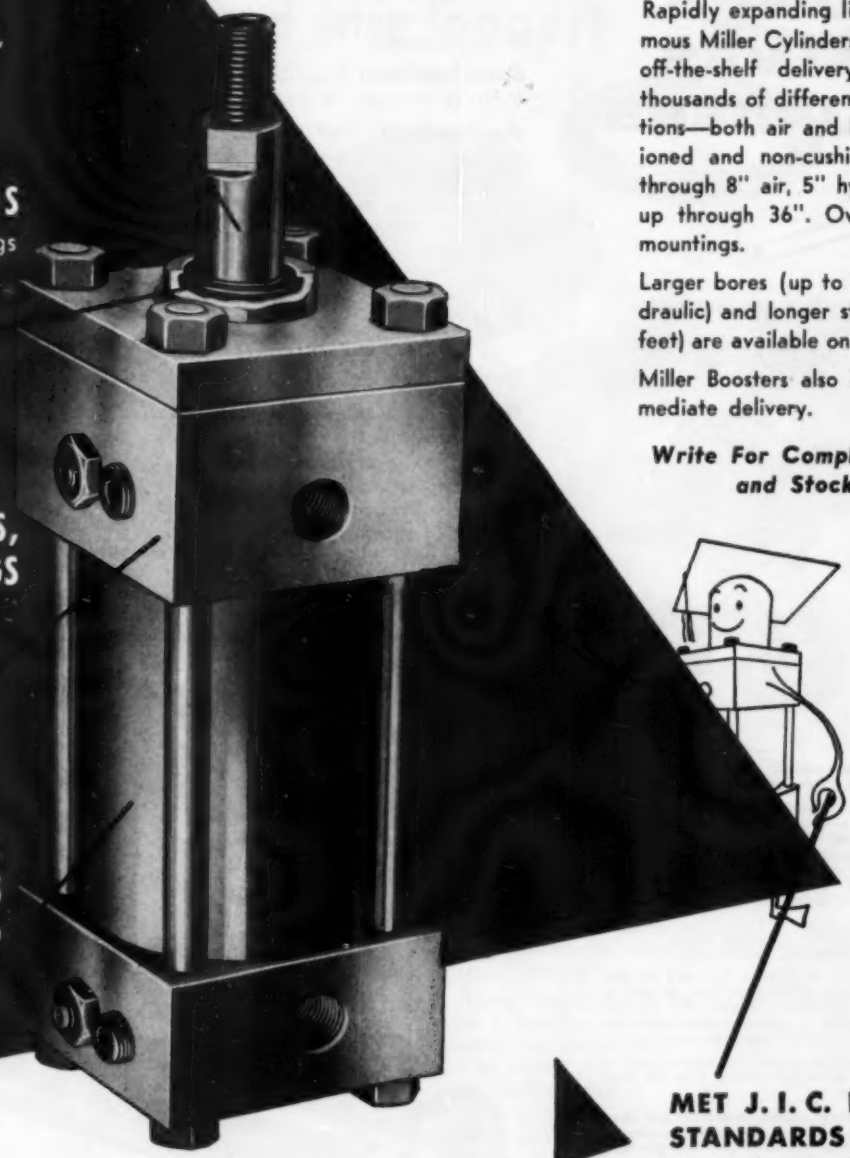
Miller AIR CYLINDERS

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

BRASS BARRELS
Eliminate Rust and Corrosion



In Thousands of Different Selections For Immediate Delivery!

Rapidly expanding list of quality-famous Miller Cylinders for immediate, off-the-shelf delivery now includes thousands of different, popular selections—both air and hydraulic—cushioned and non-cushioned. Bores up through 8" air, 5" hydraulic. Strokes up through 36". Over 30 different mountings.

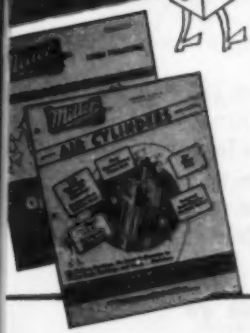
Larger bores (up to 20" air, 12" hydraulic) and longer strokes (up to 22 feet) are available on longer delivery.

Miller Boosters also in stock for immediate delivery.

Write For Complete Catalog and Stock List

MET J. I. C. PNEUMATIC STANDARDS years before their adoption in 1950.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.



WRITE FOR CYLINDER BULLETINS A-105 and H-104

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

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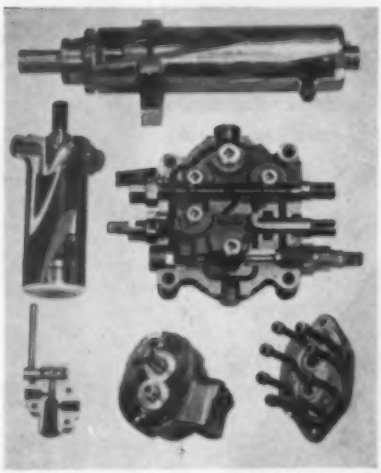
MILLER MOTOR COMPANY

2008 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

HUSCO®

PUMPS
VALVES
CYLINDERS



"Husco" manufactures many standard and special hydraulic control units which include:

Hydraulic Cylinders—all types
Control Valves—capacities to 30 GPM—2000 PSI
Lever Operated Check Valves
Reciprocating Valves
Rotating Swivels
Check Valves
Package Power Units

"HUSCO" CUSTOM BUILT HYDRAULIC CYLINDERS

Complete lines of single-acting and double-acting cylinders, differential type, as well as telescoping cylinders, are available. All cylinders are built to customer application requirements. "HUSCO" cylinders are:

(1) Designed to insure concentricity of guides which are piloted from the same diameter

(2) Adequately guided to prevent any bearing load against the packings—insuring full life of packings and safe-guarding against leakage

(3) Provided with an adjust nut for take up on the packings

"HUSCO" welcomes the opportunity to provide engineering assistance on hydraulic problems and in developing new hydraulic equipment

Used on:
Construction, Industrial, Material Handling and Agricultural Equipment

HYDRAULIC UNIT SPECIALTIES CO.
Pumps • Valves • Cylinders
Waukesha, Wis.

New Products continued

mechanical properties. Where a lubricant is required, the packing can be impregnated.

Specifications: Available in sizes from ⅛ through ⅜ inch.

Applications: For rugged and corrosive service on pump shafts and valve stems.

Crane Packing Co.
Chicago, Illinois
Circle 185 on Reader Service Card

SUMP DRAIN
. . . for pneumatic systems

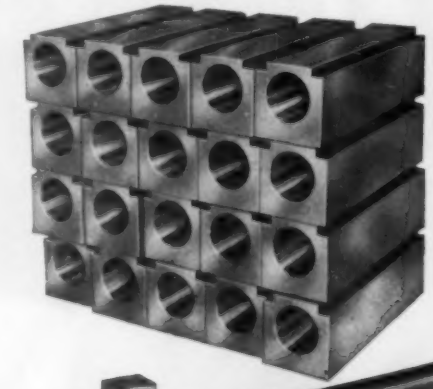
Designation: Model 150SD-4

Design: Long life and trouble free action is assured by unique design which uses a cellular plastic float to actuate an air valve. This allows full line pressure to force out accumulated moisture and other foreign material. Float is then reseated and discharge port closed without wasting air.

Features: Drain automatically collects and discharges all moisture, free oil, and contaminants at any

line pressure from 10 to 250 psi. Unit can collect and discharge over 400 gallons of water per hour.

Specifications: Drain measures 5



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AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

AMERICAN HOLLOW BORING COMPANY
1954 Raspberry St., Erie, Pa.

inches diameter by 8½ inches high and is threaded for ½-inch pipe on the inlet.

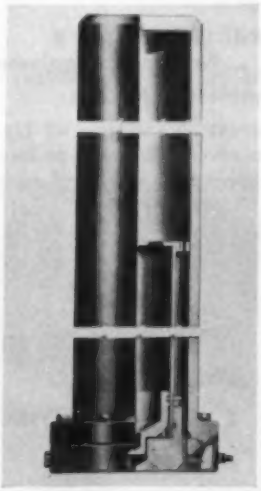
Applications: For installation on receiver tanks, air line sumps, drain legs, pneumatic storage tanks, etc.

Wilkerson Corp.
Englewood, Colorado
Circle 186 on Reader Service Card

LARGE ACCUMULATOR

. . . delivers 10 gallons of oil with 10% pressure drop

Design: This separator type accumulator has a floating piston which transmits the pressure of the precharged gas to the working medium and prevents entrainment of the gas into the hydraulic fluid. The outer shell acts as a gas container and also as a protective cover. The piston is designed with a dashpot to decelerate piston travel, eliminating hammering. This makes entire swept volume of the unit available for work. Accumulator is equipped



with spiral Teflon back-up rings and standard O-rings. The piston has pressure balancing ports to provide equal pressure to either side of both rings. This eliminates the tendency to extrude, and the possibility of pressure lock between the O-rings.

Operation: Accumulator is the hydropneumatic type. Its operation is based on Boyle's Law.

Specifications: This accumulator is designed for 2000 psi and delivers 2310 cubic inches of oil with a pressure drop of 10%. It has a net gas capacity of 21,950 cubic inches.

Superior Hydraulics Division
Cleveland, Ohio
Circle 187 on Reader Service Card

Continued on next page

have a special need for a packing that will seal better and last longer?

specify Tannate® LEATHER PACKINGS*

1. They're job engineered from start to finish by Rhoads Engineers. Rhoads Tannate Leather Packings provide an effective seal against hydraulic oils, oil emulsions, water and many other gases and liquids. They will not readily cold flow and unlike some packings which are slightly abrasive and score cylinders, Tannate Packings hone or polish metal surfaces through sliding action.

2. They're made from specially tanned leather to enable them to slide smoothly without chatter.

3. There are filters available for pressures from a few ounces to many thousands of pounds per square inch. Tannate packings can be made "rock hard" or flexible to meet your requirements.

4. They're precision molded and accurately finished to fit snugly against shafts and cylinder walls. The exacting dimensions to which Tannate packings are manufactured insures a leak-proof seal.

*Available as U, Vee Cup and Flange leathers and discs for hydraulic and pneumatic equipment.

Send for the Rhoads Packing Data File. No Obligation.

RHOADS
INDUSTRIAL LEATHERS

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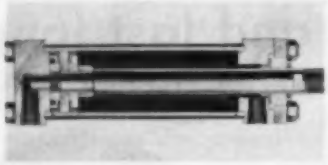
Circle 85 on Reader Service Card

New Products continued

HYDRAULIC CYLINDER
. . . offers mounting flexibility



Designation: Compact Cylinders

Design: Units occupy minimum space due to use of square rod end and head end caps which house the pipe connections. Mounting flexibility is achieved through provision for multiple positioning of ports and air vents. Each port can be independently rotated to any 90 degree position in relation to the mounting.

Features: This line of cylinders can be furnished with adjustable hydraulic cushions on either or both ends to decelerate piston rod movement. Units can be obtained with standard or heavy duty piston rods. Added flexibility is provided with the availability of five different mountings.

Specifications: Available in standard sizes from 1½ inch to 6 inch bore. Maximum working pressure is 2000 psi.

Applications: Recommended for machine tool, metalworking and general purpose industrial applications.

Vickers Incorporated
Detroit, Michigan

Circle 188 on Reader Service Card

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies—and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

Get complete data on Surgepruf:
WRITE FOR BULLETIN H-100c
Consult a Joy Engineer

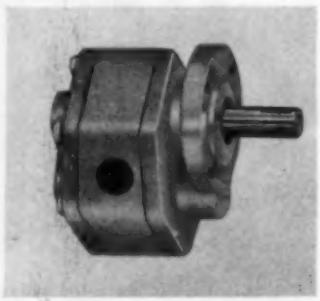
JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

W&D H5515

HYDRAULIC MOTORS
. . . for mobile equipment

Designation: SM Series

Features: New line of lightweight, reversible, gear-type motors is available in a variety of mountings and portings.



Specifications: Motors are rated for 1000 psi continuous duty and develop .10 to 7.5 hp.

Applications: For farm and road building machinery and truck mounted equipment.

Wisconsin Hydraulics, Inc.
Milwaukee, Wisconsin

Circle 189 on Reader Service Card

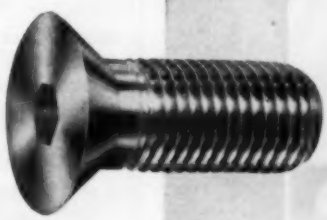
PNEUMATIC SOLENOID VALVES
. . . for 5 to 125 psi service

Design: New group of double-solenoid, pilot operated air control valves include following types: mo-

Continued on page 108

Circle 97 on Reader Service Card

specify standard



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Flat Head

SOCKET CAP SCREWS

for assembling thin-section materials

Head design permits flush assembly. Uniform 82° angle under head provides maximum contact. Accurate hex socket assures positive, nonslip wrenching. Standard sizes—#4 to ¾" in a full range of lengths—are stocked by authorized industrial distributors. Ask your supplier for Bulletin 877. Or write STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

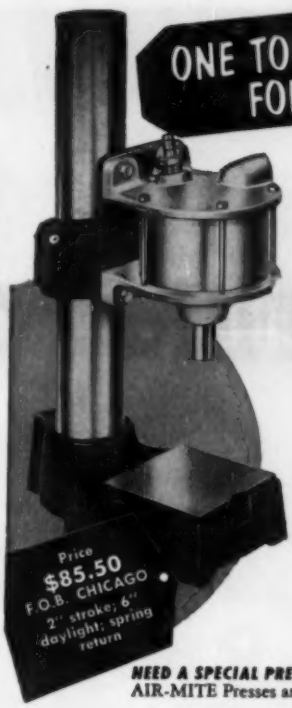
UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN PENNSYLVANIA

Circle 4 on Reader Service Card

ONE TON AIR PRESS FOR $85.50?



YES—AND YOU CAN'T BEAT IT FOR QUALITY!

- Solid Steel Column
- Brass Cylinder, Aluminum End Castings, Neoprene Piston Cups
- Accurately ground 5" x 5" table
- Quick set-up and stroke adjustment

You get more for your money when you choose AIR-MITE—more press, more utility and more production. Built by air press specialists to meet the demand for a low cost unit that could stand the gaff of high production work. AIR-MITE presses are made in ⅛, ⅜, ⅝ and 1 ton capacities with spring or air return.

Write for complete catalog on AIR-MITE Presses and Cylinders.

NEW! 3 WAY CONTROL VALVE

Provides instantaneous cylinder response, insures safer, more efficient air press operation. Get full details today.

NEED A SPECIAL PRESS? Many special adaptations of AIR-MITE Presses are available. Write us your needs.

AIR-MITE Devices, Inc.

4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

Shell Process Bonding Machine Equipped with NOPAK 8" Model D Cylinder.

This machine which produces shell molds employs 2 NOPAK Cylinders to invert investment box and to open the louver which releases the mix.

SHELL PROCESS Equipment Utilizes NOPAK Cylinder Power

Builder of "Shell Molding" Equipment... Shell Process, Inc., of Chicopee, Mass., employs NOPAK Cylinders in a number of its machines to provide the controlled power necessary for their successful operation.

The top illustration shows a bonding machine utilizing the shell molds produced in the machine pictured below. An 8" Model "D" NOPAK Cylinder advances and retracts the upper pressure plate which, in turn, applies the pressure, through pins and springs, required to seal the two halves of the shell mold before molten metal is poured between them.

The lower picture shows a machine which produces shell molds by the investment process, employing a 4" NOPAK Cylinder to operate the louver of the investment box containing the sand and resin mix which is deposited on the heated pattern. A 6" NOPAK Cylinder, visible in base, rotates the investment box 210°.

Whether you build machines for resale, or for use in your own plant, NOPAK Cylinders and Valves can be used to your advantage in the efficient application and control of fluid power.

GALLAND-HENNING NOPAK DIVISION

2743 SOUTH 31ST STREET • MILWAUKEE 46, WISCONSIN

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NOPAK

VALVES AND CYLINDERS

DESIGNED for AIR and HYDRAULIC SERVICE

Circle 35 on Reader Service Card

WEAR-SAVERS THAT WON'T STEAL POWER

Hydraulic cylinder makers use Chicago Rawhide's Type G wiper seals for many reasons. Here's one: the special Sirvis leather wiper element holds its own lubricant—operates at low friction. This means negligible power loss. Another advantage: the Sirvis leather element will not trap grit and carry it—will not score the shaft. Years of dependable performance have demonstrated the ability of C/R Type G Oil Seals to exclude dirt, dust and moisture. They may be the answer to your problem, too. Write for your copy of "C/R Perfect Oil Seals."

C/R PERFECT Oil Seals

More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device.

CHICAGO RAWHIDE MANUFACTURING COMPANY

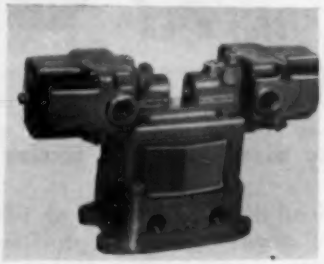
1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois

IN CANADA: SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

Other C/R *products*

SERVENE (Synthetic rubber) diaphragms, boots, gaskets and similar parts for critical operating conditions • COMPOR: Controlled porosity mechanical leather packings and other sealing products • SIRVIS: Mechanical leather boots, gaskets, packings and related products.

mentary contact 4-way, spring-centered three position 4-way, and double three way. Momentary contact version is made in both the single inlet and dual inlet models. The three-position spring centered



valves are provided with both open center and closed center porting. All valves are base mounted, side and bottom porting is standard. They are completely sealed, gasketed, and oil and dust tight. Solenoid covers are of cast aluminum, fastened with captive screws which cannot fall out when covers are removed. Removable pipe plugs are provided for manual cycling during setup or trouble shooting.

Specifications: Valves are designed for service on 5 to 125 psi and will operate on vacuum. They may be mounted in any position and are continuously rated.

Numatic Operating Valves
Milford, Michigan

Circle 190 on Reader Service Card

ROTARY SOLENOID . . . with adjustable spring return

Designation: BD5S and BD5E

Design: The return spring of this rotary solenoid is adjusted with a

special wrench which is furnished with solenoid. Gear teeth on the anchor plate mesh with a small pinion gear. Rotating the pinion gear drives the anchor plate to a precise adjustment. Setting is locked by tightening lock screw against anchor plate.

Applications: Solenoid is recommended for applications requiring close tolerance on the return spring settings.

G. H. Leland, Inc.
Dayton, Ohio

Circle 191 on Reader Service Card

AIR CYLINDER
. . . for aircraft use

Designation: Model RD-10400

Design: Stainless steel cylinder requires no lubrication on piston rod. No mounting bracket is required as the assembly connects directly through a ¼-inch hole in the swivel end and a 15/32 hole in the cylinder end. This gives flexibility at both ends.

Specifications: With 100 psi air pressure, cylinder exerts 240 lbs force on extend stroke and 220 lbs

on return stroke. Rod has a 5½-inch stroke and has ⅜-inch adjustment. Piston does not leak more than 2.6 cu ft/min with 200 psi air applied. A force of less than 5 lbs moves the piston through a full stroke. Weight is 2⅞ lbs.

Applications: Cylinder is designed for group-mounting radially around afterburner nozzle of aircraft engine, and is powered by air taken from the engine compressor.

Lear, Inc. Lear-Romec Div.
Elyria, Ohio

Circle 192 on Reader Service Card

COAXIAL VALVE
. . . combines metering and by-pass

Features: The metering valve is regulated by a vernier adjustment to provide an accurate flow under

Continued on next page

They fight conditions tough enough to kill the life in most leathers. But Sirvis mechanical boots keep right on working and protecting. Here's why: they're engineered to the most exacting specifications for dirt exclusion and lubricant retention . . . and are made from our own specially tanned and treated Sirvis leathers to assure absolute dependability. Whenever your sealing problem involves reciprocating, eccentric or universal action, let Sirvis engineers solve it. They've been doing it for 77 years. Chicago Rawhide also manufactures boots of canvas, nylon and elastomer-impregnated fabric. Write for detailed information.

C/R SIRVIS
MECHANICAL LEATHER PRODUCTS

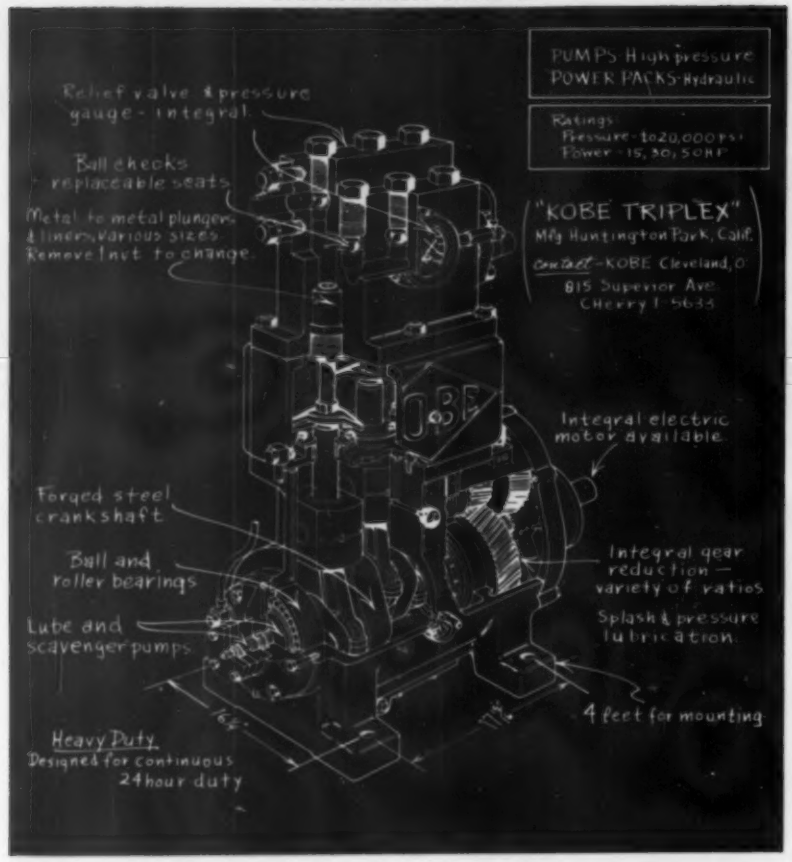
CHICAGO RAWHIDE MANUFACTURING COMPANY
1301 Elston Avenue SIRVIS DIVISION Chicago 22, Illinois
IN CANADA: SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

Other C/R products

OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • SIRVENE: (Synthetic rubber) diaphragms, boots, gaskets, and similar parts for critical operating conditions • CONPOR: Controlled porosity mechanical leather packings and other sealing products.

Circle 23 on Reader Service Card

Circle 56 on Reader Service Card


PUMPS High pressure
POWER PACKS Hydraulic
Ratings
Pressure - to 20,000 PSI
Power - 15, 30, 50 HP
"KOBE TRIPLEX"
Mfg Huntington Park, Calif.
Contact - KOBE Cleveland, O
815 Superior Ave.
CHerry 1-5635
Relief valve & pressure gauge - integral
Ball checks replaceable seats
Metal to metal plungers & liners, various sizes. Remove unit to change
Integral electric motor available
Forged steel crankshaft
Ball and roller bearings
Integral gear reduction — variety of ratios
Lube and scavenger pumps
Splash & pressure lubrication
4 feet for mounting
Heavy Duty
Designed for continuous 24 hour duty

New Products / continued

constant pressure. Valve is designed for hydraulic and pneumatic systems with pressures to 5000 psi. Readily adjusted and serviced, the valve eliminates auxiliary devices and combines in one extremely small and compact unit the functions of both a precision metering valve and by-pass valve. Unit is available in manual and motor driven types.

Ard Manufacturing Corp.
Meriden, Connecticut
Circle 193 on Reader Service Card

ELECTRONIC AMPLIFIER . . . for servo valves

Designation: Model 32

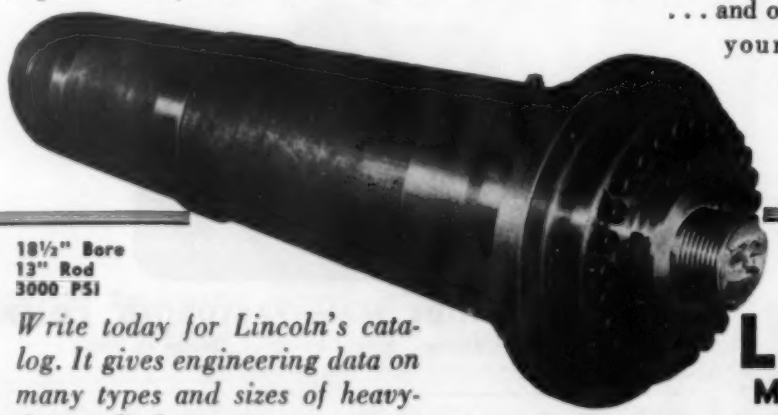
Design: 8-tube servo-amplifier is designed to drive pneumatic or hydraulic servo valves in power servo applications. Amplifier has variable frequency dither oscillator, 4 kc oscillator to excite variable reluctance or E-type transformer pickoffs, and provision for plug-in compensating networks to alter servo system dynamic response when required.

Air and Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 60" DIAMETER • STROKES OF 50 FT. AND LONGER

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.



18½" Bore
13" Rod
3000 PSI

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN
MACHINE CO., INC.
326 West 2nd Street—Salem, Ohio

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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
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11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

Features: Servo-amplifier has excellent dynamic response, permitting very high natural frequencies of the servo system with suitable supplementary components. Front panel has controls for gain, dither frequency, dither level, balance, and

output level. Meter indicates either output current level or system balance. Output level is adjustable from 8 to 20 ma.

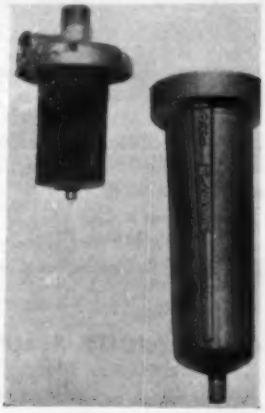
Applications: A typical laboratory use is as a component in testing operating characteristics of hydraulic servo valves before they are installed in complex systems.

Raymond Atchley, Inc.
Los Angeles, California
Circle 194 on Reader Service Card

PNEUMATIC FILTER . . . with Teflon cartridge

Designation: "Dri-Kleer"

Features: Teflon cartridge is chemically inert and water repellent. This prevents accumulation of water which is major cause of clogging in other materials. Air flow



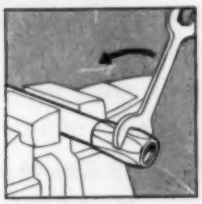
rate remains high because incoming moisture literally "rolls off" Teflon fibers to collect at base of receptacle for easy removal.

Specifications: Filter is rated at 20 cfm at a maximum operating pressure of 125 psi. Pipe connections are ¼ inch.

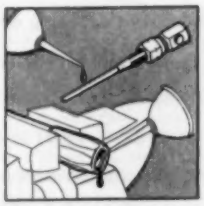
Porous Plastic Filter Co.
Glen Cove, N.Y.
Circle 195 on Reader Service Card

Continued on next page

1. Cut hose to length.



2. Screw on socket.



3. Oil inside and insert assembly tool.

4. Screw swivel nipple or male fitting into socket and remove tool.

★ *Re-Usable* **Hose Fittings**

★ *All-Purpose* **Flexible Hose**

Making up STRATOFLEX Hose Assemblies in your own shop or in the field often saves valuable time. The cost of replacing hose lines can be drastically reduced by installing new STRATOFLEX Hose and reusing the detachable fittings. It pays to keep on hand a supply of STRATOFLEX Hose and Fittings. Order from your dealer or write for FREE catalog today!

Dealerships available in some areas.

STRATOFLEX

STRATOFLEX, INC./FORT WORTH, TEXAS/P. O. BOX 10398

BRANCH PLANTS: Los Angeles and Toronto

SALES OFFICES: Atlanta, Chicago, Dayton, Houston, Kansas City, New York, Portland, Tulsa.

Circle 99 on Reader Service Card

New Products continued

ROD END BEARINGS
. . . for extreme vibration

Designation: "SCREF", "SCREM"

Features: Self-aligning plain spherical rod end bearings reduce lost motion in linkages. They carry heavier loads than anti-friction types, because they have a greater surface supporting area. Made of one-piece ball and one-piece race, they take a greater radial and axial thrust load and offer longer life.

Specifications: "SCREF" AND "SCREM" are designations for female and male threads. Bearings are available in sizes for 3/16 to ¾-inch bore and larger. Capacities of radial loads are from 1670 to 15,600 lbs. and higher.

Southwest Products Sales Corp.
Duarte, California

Circle 196 on Reader Service Card

New booklet describes advantages of Superior hydraulic quality tubing

Tubing is the modern, efficient method of handling fluids. Because it saves space and weight and is easily bent and flared, the number of fittings required is reduced and so are installation costs. In addition, it offers tighter joints, greater strength, and less pressure drop.

Seamless hydraulic tubing has been a SUPERIOR speciality for many years. From the melting of the steel to the final flare testing of the finished tube, the production of SUPERIOR low-carbon tubing is a quality operation. Tubing is given a 100% hydrostatic test at pressures which raise the fiber stress to 15,000 psi—in many sizes well above the 1000 psi minimum required by SAE-JIC specifications. Carbon content is held to .12% maximum for greater ease of bending and flaring, and each order is tested for flareability. The steel used is of a non-aging type made under a special melting process to insure low yield strength and unusually high elongation. Sizes range from ⅛" to 1⅛" OD.

Complete information concerning SUPERIOR HYDRAULIC tubing, including maximum working pressures, bursting pressures, velocity and flow charts, etc., is contained in a new booklet, shortly to be published. Use the coupon to obtain your free copy, testing samples—and the name of the SUPERIOR distributor nearest you. On the West Coast, write Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif.

SUPERIOR TUBE COMPANY
2030 Germantown Ave., Norristown, Pa.

☐ Please send me a free copy of Bulletin 39 on Superior Hydraulic Tubing as soon as it is released.

☐ Send me a free sample of hydraulic tubing " OD and " wall to be used for_____.

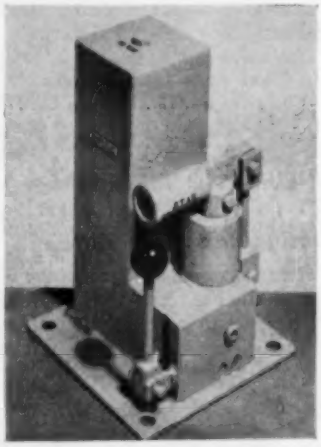
☐ I would like to know the name of the distributor nearest me.

Name.....
Title.....
Company.....
Street.....
City..... Zone.... State.....

MANUAL PUMP
. . . has automatic speed change

Designation: "Hi-Lo"

Design: Two-speed concentric piston pump is available for hand or foot operation. Hydraulic rams are raised speedily until a fixed pressure is reached. At this point the high pressure concentric piston automatically takes over to generate as much as 10,000 psi.



Star Jack Co., Inc.
River Grove, Ill.

Circle 197 on Reader Service Card

SMALL CAPACITY PUMP
. . . combines piston and diaphragm

Designation: "Microflo" Pulsafeeder

Design: Fluid being pumped is isolated from all pumping parts by a hydraulically balanced diaphragm and is kept safe from contamination and leakage. Pump has no stuffing box, packing, or running seal to come in contact with the fluid.

Features: Unit performs precision

Continued on page 114

Circle 50 on Reader Service Card

Make Quality J.I.C. Flares Quickly in the Field with IMPERIAL 37° FLARING TOOLS

YOU'LL make J.I.C. 37° flares in the field even better than production flares with the Imperial **No. 400-F** Rol-Air type Flaring Tool. Makes stronger flares; does not mar the tubing. Rollers in flaring cone make flaring easier. This outstanding tool automatically burnishes flares assuring tighter joints. Gauge accurately controls size of flares.

No. 400-F flares 3/16", ¼", 5/16", ⅜", ½" and ⅝" O.D. tubing to J.I.C. and AN standards. Each $25.50.

No. 537-F flares ¾", ⅞", 1" and 1¼" O.D. Each $39.75.

No. 637-F flares 1½", 1¾" and 2" O.D. Each $149.50

For other 37° Flaring Tools, also tube cutters, tube benders, 45° flaring tools, etc., ask for Catalog 3011.

See Your Supply House

THE IMPERIAL BRASS MFG. CO. 1242 W. Harrison, Chicago 7, Ill.
In Canada: 334 Lauder Avenue, Toronto, Ontario

IMPERIAL Industry's Most Complete Line of Tube Fittings and Tubing Tools

Here's Something NEW IN NEEDLE VALVES!

Hoke's 270 series bar stock needle valves have all these new ideas—

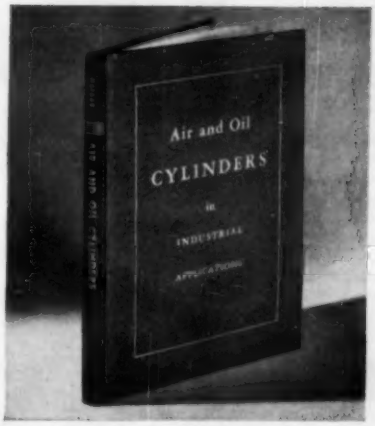
- O-ring stem seal eliminates leaks and adjustments (handle turns with fingertip control).
- Self-aligning stem for tight closing (no wrenches needed).
- Panel mounting, if needed, for instrument panel and hydraulic test stand service.
- and of course, the back-seating feature makes it possible to replace O-ring or packing under pressure.

Brass or stainless—Sizes ⅛" to ½" pipe. You can use them for pneumatic or hydraulic service or precision laboratory work. We'll be glad to send you catalog and data sheets.

HOKE

HOKE INCORPORATED
Fluid Control Specialists
187 S. DEAN STREET, ENGLEWOOD, N. J.

AIR and OIL CYLINDERS in INDUSTRIAL APPLICATIONS



Design and production men who have this book are saying . . .

"A fabulously rich mine of practical information."
"Admirably down to earth."
"Certainly the most readable book devoted to the subject of pneumatic and hydraulic power cylinders."
"Will interest the maximum number of readers."
"Theory and technical explanations are clearly and concisely presented."
"The essence of the book is that it manages to be at one and the same time forceful, amusing, easy on the brain and, not least, a valuable treatise on a little documented subject."

These are the reasons why an increasing number of copies are now being sold as repeat orders.

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The Industrial Publishing Group
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Remittance enclosed ☐; Bill our company ☐ Bill me ☐

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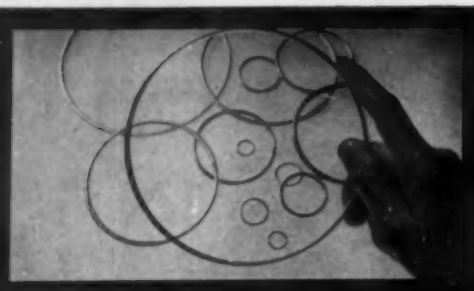
Circle 105 on Reader Service Card

CYLINDER HEADS
HYDRAULIC PRESSURES
HIGH OCTANE FUELS
AIR PRESSURES
VACUUM CONNECTIONS
VAPORS AND GASES
OILS AND SOLVENTS
STEAM CONNECTIONS
CHEMICALS AND ACIDS



Sealed with... *metallic O-rings*

Self Energizing Feature

. . . as applied to Metallic O-Rings is United's answer to the positive, permanent control of high pressures with a metal-to-metal static seal. Drilling holes through the I.D. wall of the O-Ring creates a unique method of venting the tube of the ring to allow the sealed pressures to enter the ring. A balance of pressure then exists within the O-Rings to prevent its collapse. An unbalance of pressure forces exists across the sealing surfaces to increase the resilience of the O-Ring.

22 pages of engineering data—write for your copy today (on your company letterhead please) to Department F2

METALS

1. Steel-SAE 1020 (Not Recommended for Self-Energizing) (Special)
2. Stainless Steel — Type 321 (Standard)
3. Al. Alloy 35 (Spec. WW-T-788) (Special)
4. Copper — Pure (Spec. WW-T-797) (Special)
5. Inconel (Special)

UNITED AIRCRAFT PRODUCTS, INC.
Box 1035, Dayton 1, Ohio

New Products / continued

pumping, metering, feeding, and proportioning of fluids at pressures up to 1000 psi and rates to 2400 ml.

per hour. Pumping rate, established by the length of the piston stroke, is handset on a dial indicator which regulates pump capacity from 0 to 100%.

Lapp Insulator Co., Inc.
Le Roy, New York

Circle 198 on Reader Service Card

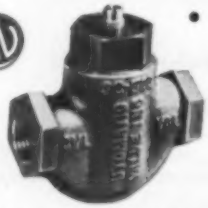
AIR-HYDRAULIC BOOSTER . . . heavy duty, double acting

Design: Booster consists of double rod end air cylinder with a hydraulic chamber at each end. Thus

Solenoid VALVES

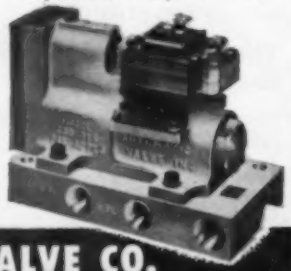
PILOT VALVES
3-WAY 4-WAY
For operating Master Valves and Small Cylinders

• • •



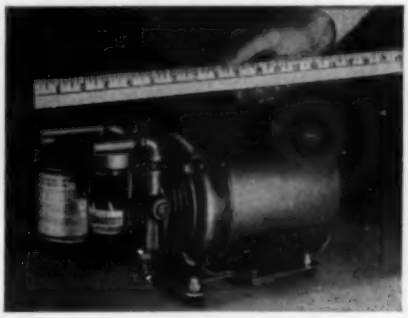
***Speed Control* VALVE**
Controls speed of Air and Hydraulic Cylinders

***3-Way and 4-Way* VALVES**
Pilot Operated
Sizes ¼" — ⅜" ½" and ¾"
Write for Bulletin



AUTOMATIC VALVE CO.
37423 GRAND RIVER AVE., FARMINGTON, MICH.

NEW GAST Model 0211 AIR PUMP weighs ⅓ less — is a truly



COMPACT COMPONENT

This *new* Gast rotary-vane Air Pump offers many advantages, including: ⅓ less weight — (now 22 lbs.) — with more compact, streamlined design. Rotor mounted on new G. E. Form "G" motor shaft. Vanes give positive, pulseless air delivery. Rubber-cradled mounting dampens vibration, increases quiet.

Model 0211 produces up to 25 p.s.i. or 27" vac., or 1.3 c.f.m. running open. ⅛ h.p. motor uses only 3.8 amps. Ideal for automatic machines, industrial instruments and controls. Present uses: paper feeding in packaging, printing frames, or as portable laboratory air source.

Let *your* product benefit from this compact component — *write for Bulletin 1254 and "Application Ideas" Booklet!* **Gast Manufacturing Corp.,** P.O. Box 117-D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
• AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File

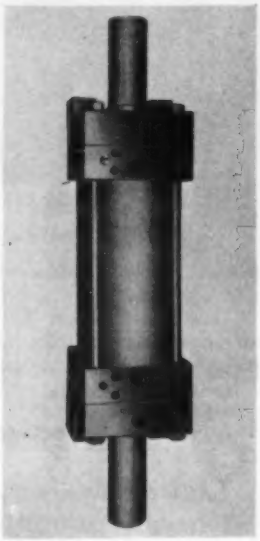
Circle 11 on Reader Service Card

Circle 36 on Reader Service Card

it delivers a pressure output stroke in both directions.

Features: Operating from ordinary plant line pressure, the reciprocating booster can deliver an unlimited amount of high pressure fluid for the operation of hydraulic cylinders where large volumes of high pressure fluid are required. At the end of each stroke, the piston contacts an actuator on the inside of the cylinder. The actuator operates a 2-position valve reversing the booster stroke.

Specifications: Booster is available in all ratios to give pressures to 10,000 psi and above. Unit with



a ratio of 25 to 1 produces 2000 psi hydraulic output from 80 psi air input and consists of a 5-inch diameter air piston driving two 1-inch diameter hydraulic rams. Each ram has a stroke of 6 inches and an oil displacement of 4.7 cubic inches per stroke.

Applications: Booster is recommended for operations requiring high holding pressure without generating heat or wear and without consuming power. It is also well adapted for handling special output fluids.

Miller Fluid Power Co.
Melrose Park, Illinois
Circle 199 on Reader Service Card

TEMPERATURE ACTUATED VALVE

. . . for flow control

Designation: Type WT, Type HT

Features: Type WT opens with a rise in temperature and closes with a drop in temperature. Type HT closes with a rise in temperature and opens with a fall in tem-

Continued on next page

75,000 psi PUMPS

To ½ gpm

KIMCO PACKAGED PUMP UNITS Fingertip Control allows precise regulation of pressure. Unit consists of hydraulic powered pressure booster driven by smooth dependable oil system. Available in complete range of sizes and ready to connect to source of electrical power.

AIR POWERED TEST PUMPS Compact and economical for pressures to 75,000 psi from shop air.

WELL INJECTION UNITS Engine driven portable pump units for high volume chemical injection to 5 gpm at 10,000 psi.

FITTINGS Valves, vessels and fittings for severe applications.

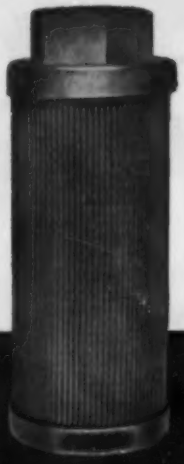
KIMCO
Pressure Products

Box 13383 **Houston 19, Texas**

Circle 55 on Reader Service Card

Circle 16 on Reader Service Card

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



The New

CAPITAL HYDRAULIC OIL FILTER

WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

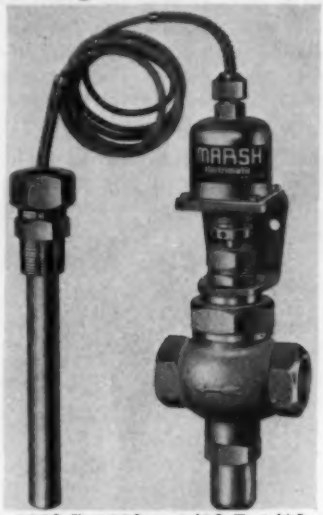
CAPITAL ENGINEERING & MFG. CORP.

5837 South Ashland Avenue Chicago 36, Illinois

New Products / continued

perature. Valves are direct or pilot operated.

Specifications: Standard temperature ranges are 20° to 60° F, 60°

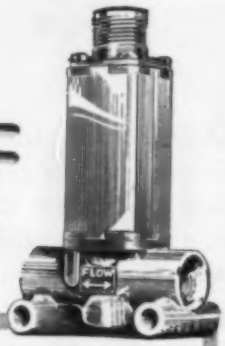


to 100° F, 100° to 140° F, 140° to 180° F, 160° to 220° F. Liquid pressure range is up to 150 lbs. Various type and size bulbs are available.

The Electrimatic Co.
Skokie, Illinois

Circle 200 on Reader Service Card

MAXIMUM FLOW = MINIMUM WEIGHT



New Valcor Solenoid Valves . . . with the highest ratio of flow to weight of any Valve made. They are low in weight; low in pressure drop; low in power consumption; . . . and low in cost. No other Solenoid Valve but VALCOR is so completely depended upon in so many critical applications

SPECIFICATIONS:
Weight—1/3 lbs.
Ambient Temperature—minus 65° to plus 180° F.
Max. Leakage—½ cc/hr. fuel 10 cc/min. air
Current Drain — ½ amperes @ 24 V.D.C. Designed in accordance with MIL-V-8610 (ASG) and MIL-E-5009A

Valcor Valve Part No.	Type	Max. Operating Pressure
V-3800	Normally Open	200 psig
V-3900	Normally Closed	100 psig
V-6800	Normally Open	300 psig
V-8400	Normally Closed	200 psig
V-8500	Normally Open	300 psig
V-6000	Normally Closed	300 psig
V-8300	Normally Open	500 psig
V-7000	Normally Closed	500 psig

Write today for detailed information

VALCOR SOLENOID VALVES

Eastern Representative: East Coast Engineering Co. Roslyn Professional Bldg., Roslyn, N. Y.
Western Representative: Rowe Sales Co. 2140 Westwood Blvd., Los Angeles 25, Calif.

VALCOR ENGINEERING CORP.
CARNEGIE AVE., KENILWORTH, N. J.

That vital "ounce of protection" that pays...

BIG DIVIDENDS

Silbhite Plastic Shipping PLUGS and CAPS

Low-cost protection against-

- Dirt, dust and moisture
- Thread damage
- Loss of liquids

Here's convenient, inexpensive protection against handling and shipping damage. Used to cover threaded openings and connections, these protective plastic plugs and caps repay their low cost many times over by eliminating unnecessary service and repair work and by reducing customer complaints. They're available for immediate delivery in a wide range of sizes in both threaded and plain types.

Bulletins P-5312 and P-5203 have full details. Write for copies, Dept. L.

C-2

THE Silbhite PLASTICS DIVISION
DENTAL MFG. CO. 10 East 40th Street New York 16, N.Y.
Western District Office • Times Building, Long Beach, California

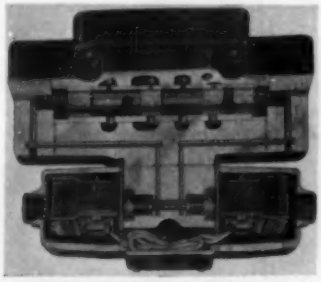
Circle 107 on Reader Service Card

Circle 114 on Reader Service Card

SOLENOID VALVE
. . . in dust-proof housing

Designation: Bulletin 59-S

Design: Solenoid-controlled, pilot-operated valve is sub-plate mounted. Spring-centered, spring-offset, or no-spring models can be readily converted from one type to another. Solenoids are contained in compact, concealed, dust-proof housings and are fastened to the valve by covers only. Removing covers prevents electrical operation.



Specifications: Valve is ¾-inch, four-way type designed for 2000 psi operation.

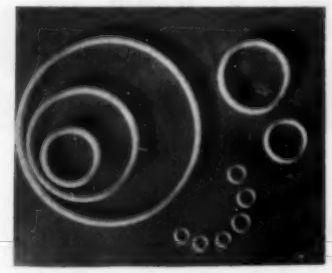
Racine Hydraulics & Machinery, Inc.
Racine, Wisconsin

Circle 201 on Reader Service Card

O-RINGS
. . . from Teflon

Designation: "Korda"

Design: O-ring design is based on the principle of the line contact compression seal. Under compression the total load is distributed over a very small area, resulting in extremely high pressure. The O-



ring can seal effectively in both static and dynamic applications.

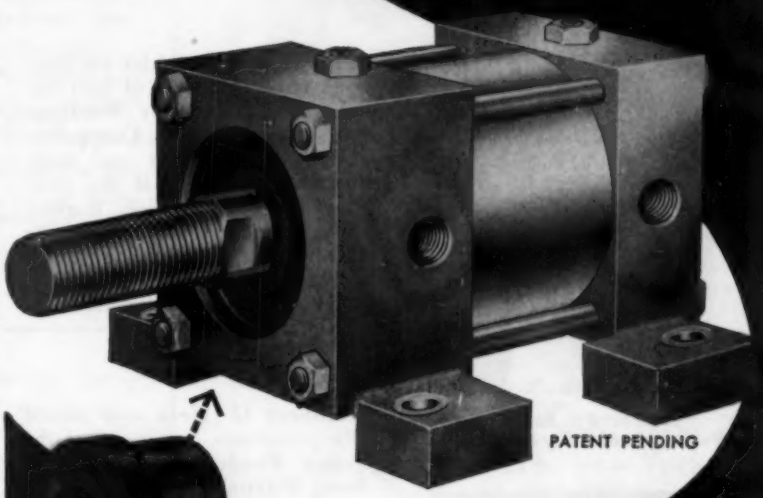
Features: Complete resistance to chemical attack, resistance to high temperatures, and extremely low coefficient of friction.

Specifications: Available in standard series 6227 and 6230 equivalent to "AN" O-ring sizes and tolerances. Also made to customer's specifications.

Chicago Gasket Co.
Chicago, Illinois

Circle 202 on Reader Service Card

*APPROVED
HEAVY-DUTY
AIR CYLINDERS
for
Automation



QUICK-CHANGE
PACKING CARTRIDGE
Cuts Downtime

Step up production with rugged, service-free S-P Heavy-Duty Air Cylinders:

- Designed for 200 PSI
- Rolled steel end plates
- Extra long cushions
- Extra large, hardened piston rod
- Minimum mounting and envelope dimensions
- 5 types of mountings
- 8 bore sizes, 1½" to 6"
- Double porting
- Interchangeable check and cushion valves
- Quick-change packing and bearing cartridge

* S-P Automation Cylinders were designed expressly for a large automobile manufacturer. They are thoroughly proven for automation and general heavy-duty applications. Prompt deliveries. Send for Catalog 109. For S-P standard Air Cylinders, request Catalog 102. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.

THE S-P MFG. CORP. — Cleveland
A Bassett Company
PRECISION PRODUCTS SINCE 1916
AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES AND ACCESSORIES

Circle 89 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Richard H. Koehler
Westinghouse Air Brake Company

Richard H. Koehler has been promoted to director of advertising and publicity for **Westinghouse Air Brake Company.** Formerly advertising and sales promotion manager at the company's Le Roi Division, Koehler will now supervise and coordinate all advertising and public relations activities of Westinghouse Air Brake Company, its divisions and subsidiaries.

Robert G. Hess
Pesco Products Division

Robert G. Hess was named vice president—operations of the **Pesco Products Division of Borg Warner Corporation.** He was formerly general manager of the Watertown Division of New York Air Brake Co.

Metal Industries Ltd., England, have acquired all assets of **Finney Presses Ltd.,** England, manufacturers of hydraulic equipment. Directors of the newly constituted company are J. Black, chairman, J. Trevor-Jones, managing, and L. Davies.

Jack Eau Claire
J. M. Grimstad Co.

Joy Manufacturing Company elected **Louis G. Helmick** as vice president of manufacturing. Helmick joined the company in 1947 as production control manager, and until his recent promotion was manager of manufacturing.

J. M. Grimstad Company have established a branch office in Rockford, Illinois. **Jack Eau Claire,** formerly with Barnes Drill, is in charge of this new office, located at 924—11th Street.

T. A. Harper will head the newly opened New York Sales office of Columbia Steel and Shafting Co., to serve accounts in the New York, Newark and northern New Jersey areas.

J. N. Rogers was assigned as a district salesman to the St. Louis, Mo. office of the **Tubular Products Division of The Babcock & Wilcox Company.** He previously served as the Division's Chicago sales office manager.

The Lima Electric Motor Company's main manufacturing plant at Lima, Ohio, is increasing its production facilities. The new construction is to be completed in three months.

Roland W. Bartlett, sales engineer, was promoted to manager of **Worthington Corporation's** Detroit district office. He was recently at the company's Washington, D.C., office.

Flow Products Incorporated, Chicago, Ill., and **Power Transmission Co.,** South Bend, Indiana, have been appointed distributors by **Republic Manufacturing Company.**

Sales and engineering offices in Phoenix, Charlotte and Denver have been opened by **Micro Switch, a Division of Minne-**

Continued on page 120

Circle 41 on Reader Service Card

Gresen HYDRAULIC RELIEF VALVE

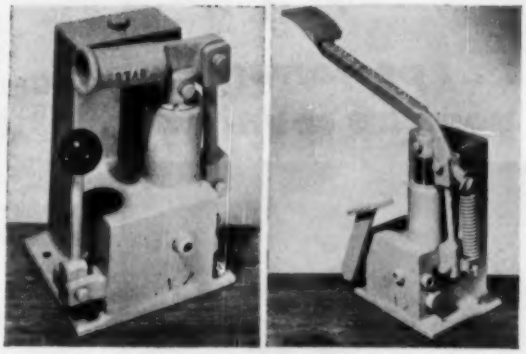
- Ball and Spring Type
- Replaceable Hardened Seat
- Smooth Performance
- Grey Cast Iron Body
- Adjustable to Your Pressure Range
- Economical Price

Write for Literature

GRESEN MANUFACTURING CO.
628 Colfax Ave. N. Dept. H-45 Minneapolis 11, Minn.

Circle 98 on Reader Service Card

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS

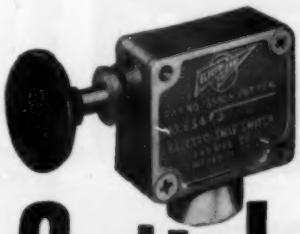


- **HAND AND FOOT OPERATED**
  Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—3 models (½"-⅞") (½"-1¼") (½"-1½")

Representative areas available

Star Jack Co., Inc.
420 Lexington Ave., New York 17
PLANT: RIVER GROVE, ILLINOIS

INDUSTRIAL



Safety Switch

ELECTRO SNAP **TYPE ES4-J**

Ideal for two hand safety on punch press

ES4-J $9.80
ES4-JM2 (Momentary) $10.80

Designed for safety, stop and start, or interlock use. Large plastic button actuator easy to operate with hand. Extremely accurate repeatability and long mechanical life (5,000,000 operations) makes switch ideal for machine control. Diecast case protects switching mechanism, provides convenient mounting and connection for conduit. SPDT, 2 circuits, at 10 amps, 125/250v AC.

STANDARD OR "ONE-WAY IMPULSE" ACTION

Two models: ES4-J "makes" and "breaks" circuit as actuator is depressed, then released. ES4-JM sends electrical impulse as actuator is depressed. Overtravel opens circuit; no impulse on return.

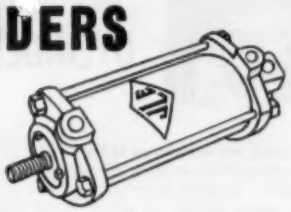
see our catalog in Product Design File or write for copy

WRITE FOR DETAILS IN DATA SHEET JF-4

ELECTRO-SNAP SWITCH AND MFG. CO.
8224 West Lake Street Chicago 24, Illinois

JLE CYLINDERS

Quality without compromise . . .



- The JLE "Work Horse" Cylinder line for air pressures to 110 psi, 250 psi hydraulic. Designed for our own exacting applications on wire machinery, is rugged and dependable. Available in four standard mountings, both cushioned and non-cushioned, in bore sizes 1½ to 10 in.
- The new JLE Square Cylinders for air and low pressure hydraulic service, are available in interchangeable stock mountings, fixed, automatic or adjustable cushions in bore sizes from 1½ to 16 inches.
- Engineering service available for all fluid power problems. Write us or contact your nearest authorized distributor.

Send for new JLE Cylinder Catalog HP 104

JAMES L. ENTWISTLE CO.
1475 Elmwood Ave. • Cranston (Prov. 7), R.I.

Circle 31 on Reader Service Card

Circle 32 on Reader Service Card

Quality

. . . performance you can count on

O-M

AIR-HYDRAULIC CYLINDERS

Designed and engineered to last . . . to give prolonged service with minimum maintenance. Husky, smooth functioning O-M cylinders are constructed of steel, with precision-machined bronze bearing surfaces. *Special Interlocking Mechanism* eliminates bulky tie-rods, end caps—saves ⅓ installation space. This feature also assures perfect alignment, lower coefficient of friction. Easily removed, inspected, repaired. Every unit power-tested to rigid standards. Standard, semi-standard, "special" air and hydraulic cylinders available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. Completely interchangeable parts. Immediate delivery on many sizes.

Write today for FREE CATALOG!

MAIL COUPON NOW!

ORTMAN-MILLER MACHINE CO.
1 143rd Street, Hammond, Indiana
☐ Have representative call ☐ Send latest catalog
☐ Send ½-scale templates
Name_____ Position_____
Company_____
Address_____
City_____ Zone____ State_____

Post Scripts of Industry

continued

apolis-Honeywell Regulator Co. Ralph C. Froehlich heads the Phoenix office, **Donald S. Schultz,** transferred from Philadelphia, is in charge of the Charlotte office, and **Richard J. Peterson** in charge at Denver.

O. B. Harding, president, **Hydro-Line Manufacturing Company,** announced the appointment of **Jack Modrich** as vice president.

Robert V. Sharkey has become general purchasing agent of **Vickers Incorporated.**

The Aeronautical Division of **Robertshaw-Fulton Controls Company** has assigned **Edward F. Harbison** as special representative for liaison with U.S.A.F.'s Air Material Command and Wright Aeronautical Development Center.

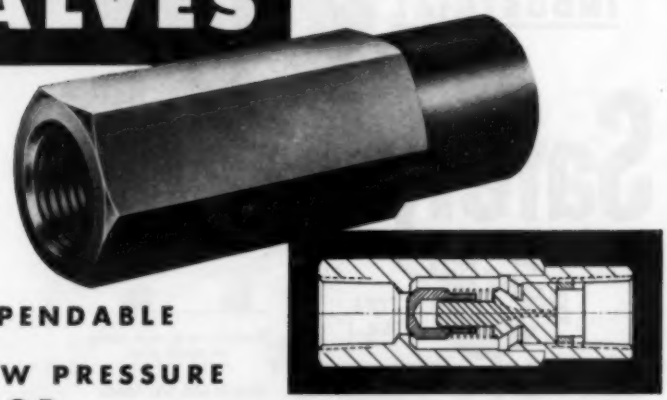
Southern Engineering Service, Inc., Miami, Florida, was appointed as authorized distributor of Parker O-rings. Henry Weaver is vice president of Southern Engineering.

Pacific Airmotive Corporation named **Russell Associates** of Brightwaters, L.I., N.Y., as sales representatives for the Aero-Pneumatics Division.

The Briggs Filtration Company has announced the following appointments: **Frederic B. Town** to district manager of the New York City area. **Frank Lewis** representing in western New York,

Continued on page 122

CHECK VALVES



■ DEPENDABLE
■ LOW PRESSURE DROP
■ LOW COST
■ FOR OIL

- For Oil
- Copper Brazed Steel Bodies
- To 3000 P.S.I. Service
- Pipe Sizes ¼", ⅜", ½", ¾"

Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.

Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

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Applied Hydraulics . . .

PRIZE PAPER CONTEST

You Have Until July 1st to Enter

Here's what you can win:

First Prize **$500.00**
Second Prize **$300.00**
Third Prize **$200.00**
Fourth through Seventh Prizes ea. **$50.00**

And in addition to cash awards:

Prize paper will receive national publicity. Major awards winners will be honored at the Eleventh Conference on Industrial Hydraulics at the La Salle Hotel, Chicago, October 27-28.

Anyone who uses, designs, builds or maintains pneumatic or hydraulic machines or equipment can enter this contest.

Your contest entry paper can describe:

A circuit design, a maintenance program, a safety circuit, the solution to a problem in speed, pressure or timing control, construction techniques, methods of component selection, testing procedures etc.

• Write today for your entry blank

Applied Hydraulics Magazine

1240 ONTARIO STREET • CLEVELAND 13, OHIO

Post Scripts of Industry
continued

including Buffalo and northwestern Pennsylvania including Erie. **J. S. Middleton** will cover central New York State, **Louis P. Grasso** northeastern New York State and **H. D. Urdanoff** northern New Jersey and Eastern Connecticut. **L. E. Foran** was named industrial sales representative for the Chicago area.

Promotion of **W. H. Parkinson** to advertising, publicity and sales promotion manager of **Quaker Rubber Corporation,** a Division of H. K. Porter Company, Inc. was announced. He was assistant advertising manager to W. M. Taylor, who was promoted to the staff of Quaker's parent company.

Lynair, Inc., have appointed **Valley Engineers,** Glendale, California, as exclusive distributors for their air and hydraulic equipment, in Southern California.

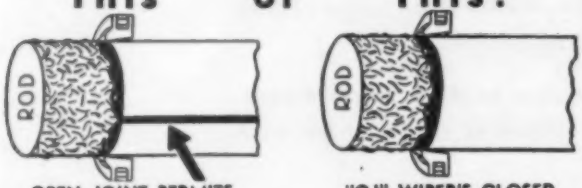
Harvey Hewitt
General Metals Corporation

Harvey Hewitt was elected a director of **General Metals Corporation.** He was until recently vice president in charge of sales for Bethlehem Pacific.

Sundstrand Hydraulic Division, in its new 106,000 square foot plant located in Rockford, has become a separate entity with its own management, sales, engineering, service and production facilities. **A. H. Swensen** was appointed manager of the new division, **C. W. Lang** continues as sales manager, **F. E. Carlson** was promoted to chief engineer, **W. R. Roper** is manager of manufacturing and **G. N. Bookland** continues as purchasing agent. The new plant was specially designed and equipped for volume production, and unusual facilities include racks for run-in of equipment, acoustically treated booths for verifying quietness of operation and many new precision instruments.

The following distributors have been appointed by the Parker Appliance Company: **Louis H. Hein Co.,** Baltimore, Maryland, for tube and hose fittings; **The Northwest Company,** Seattle 99, Washington, for O-rings, and **Hope Rubber Company, Inc.,** Watertown, Massachusetts, for tube and hose fittings.

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For these dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint
(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**
Spec. Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) and endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio

Fall Wiper Ring SPRING LOADED

Phone Adams 6313

Covered by patents issued and patents pending.

COMPRESSED AIR AND GAS COME OUT OF THE LOGAN

ARIDIFIER

Scrubbed CLEAN AND DRY

INSTALL ARIDIFIERS ON LINES SERVING

- Paint Spray Guns
- Air Tools
- Air Hoists
- Foundry Jolting Machines
- Sand Blasting Tools
- Sand Blasting Rooms
- Metal Spray Guns . . . or Wherever the line must deliver clean, dry air or gas

On any air or gas line 92% of the dirt, oil, scale and water that enter the Aridifier is trapped and removed from circulation. The Aridifier's patented centrifugal-baffle action scrubs air and gas clean and dry . . . protects equipment, prevents freezing, fouling, corrosion and caking, produces best results with spray gun and air tool operations, etc. Easy to install. Self cleaning. Maintains itself. 10 models available. Capacity 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

Write for This Catalog

Now!

Logan ENGINEERING CO.
4920 W. Lawrence Ave., Chicago 30, Ill.

Circle 1 on Reader Service Card

Circle 63 on Reader Service Card

The Rucker Company appointed **Clarence J. Woodward** vice-president in charge of sales and engineering. He was formerly sales manager. Prior to joining Rucker, Woodward was associated with the Pelton Water Wheel Co., as general manager of its Oil Industry Machinery Division.

Clarence J. Woodward
The Rucker Company

John Repar
The Parker Appliance Co.

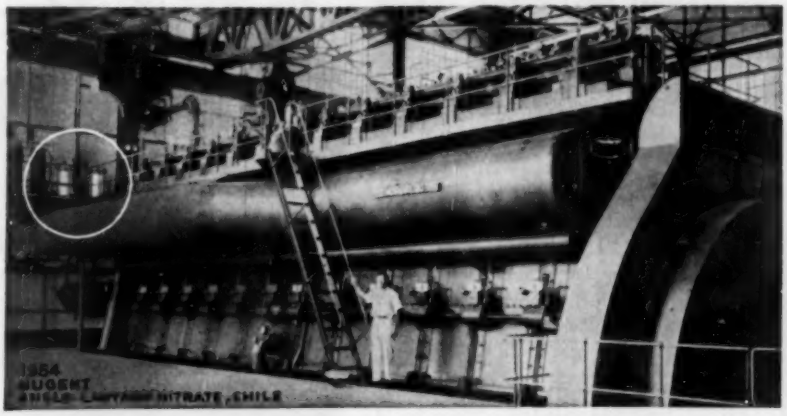
John Repar was promoted to sales engineer for the Rubber Products Division of **The Parker Appliance Company.** Repar, who joined Parker in 1950, will team up with Ted R. Carrell to cover the West Coast district.

Edward T. Day was named general sales manager of the mechanical goods division, **United States Rubber Company.** Day joined U. S. Rubber in 1934, held positions at the company's branches in Salt Lake City and Los Angeles, and prior to his promotion was manager of branch sales. **Purdy Miller** succeeds him in that position.

W. J. Purcell Company has moved to new quarters at 4112 North Avenue, Cincinnati, Ohio.

Continued on next page

MOST POWERFUL DIESELS



...rely on NUGENT FUEL OIL FILTERS!

• The giant diesel shown above is one of two, 9,600 hp. Nordberg engines installed for the Anglo-Lautaro Nitrate Corporation at their plant Coya Sur, Chile. The diesels are the most powerful single units ever built in the Western Hemisphere.

Included as original equipment on each of these engines is a Nugent #4L4 twin transfer filter (shown in circle above) for preliminary fuel oil filtering and a Nugent #4L Duplex fuel oil filter (not visible) to provide the final filtering. The Coya Sur installation is another example of Nugent filters being installed as original equipment by a leading diesel manufacturer.

Size for size, Nugent filters of the above type offer greater filtering area than any other filter on the market. In addition, the lubricating oil filters make possible a choice of full flow or by-pass with the same unit. Simple piping makes installation no problem.

No matter what the size of your own diesel power supply—no matter where it is installed, there is a Nugent fuel or lube oil filter to meet your needs. Write for complete information.

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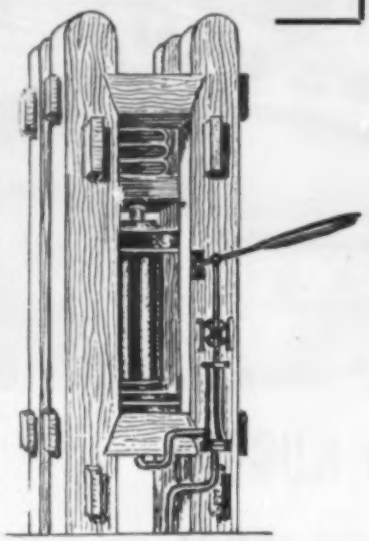

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94/98 Petty France, London, S.W. 1 England

Post Scripts of Industry

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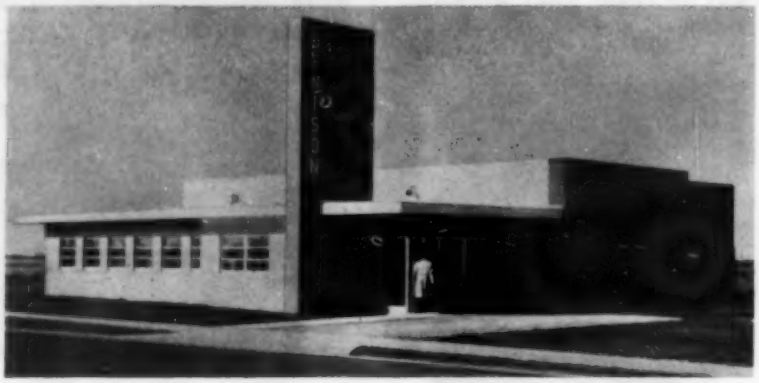

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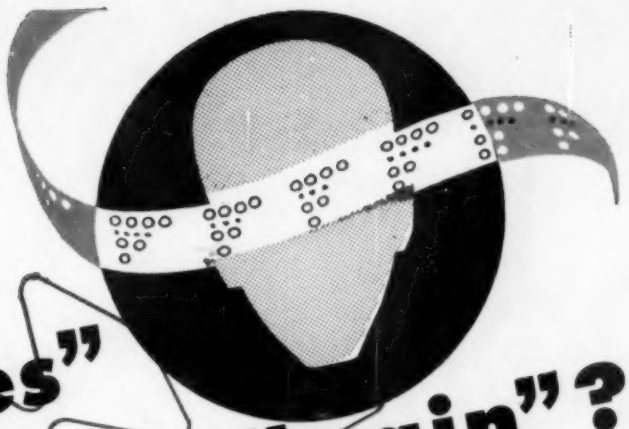

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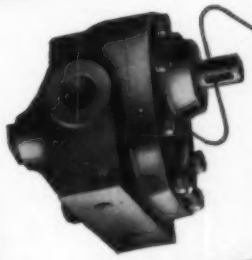

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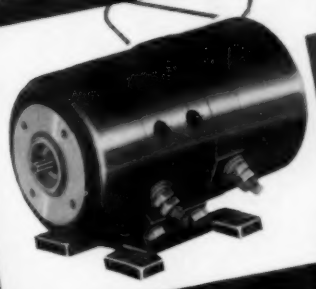

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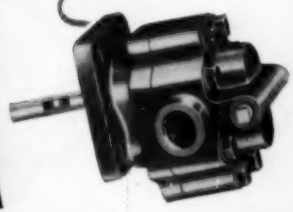

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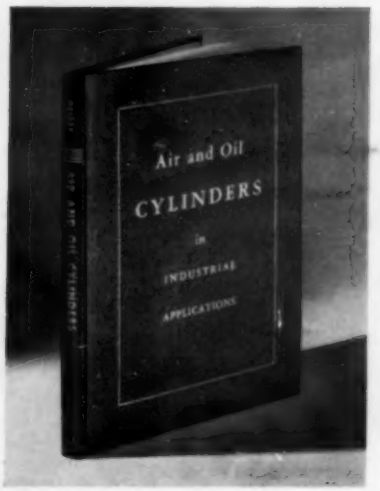

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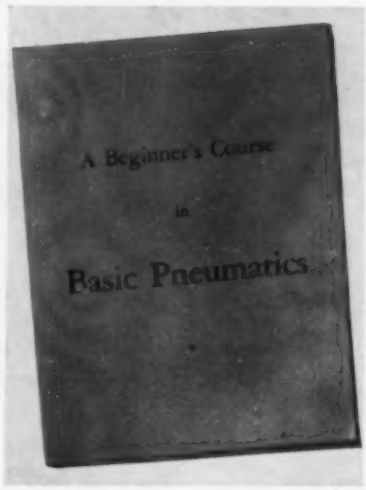

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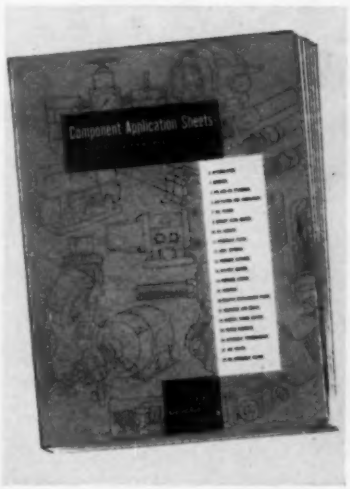

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